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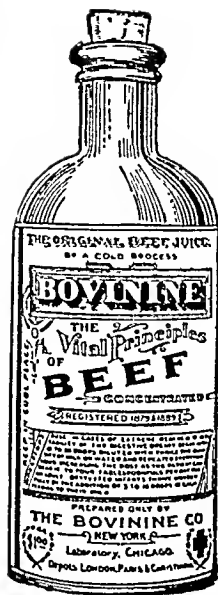
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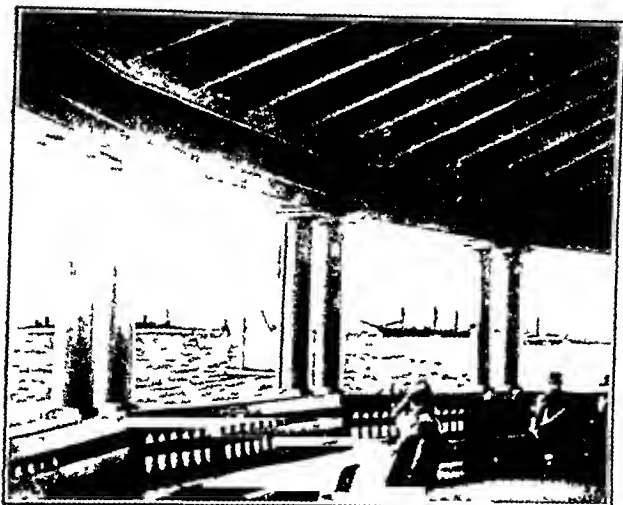
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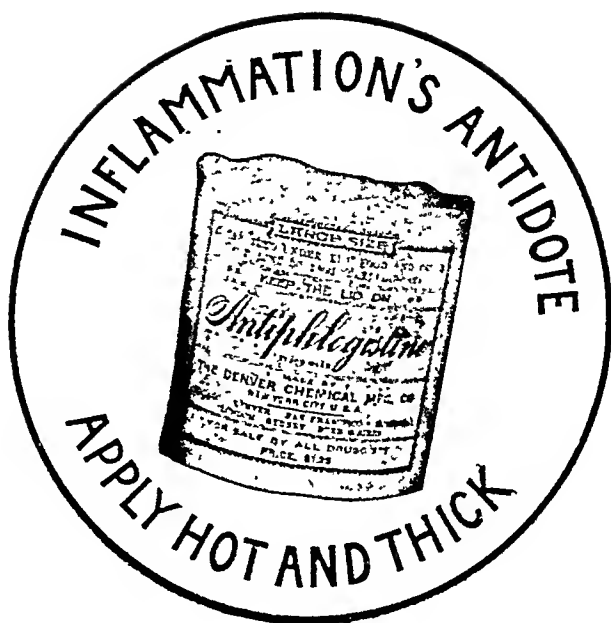
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ORIGINAL ARTICLES.

THE MEDICAL VS. THE SURGICAL TREATMENT OF GASTRIC
ULCER.¹

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THE last word concerning the treatment of gastric ulcer has not and cannot be said, because, although individuals with large experience may give reasonably mature conclusions, the cases reported are meagre, particularly as to the after-history. The medical and the surgical reports are equally culpable. The latter may be excused because operative procedures have been instituted so recently that the after-history is not of value. Technique and operative mortality have concerned the surgeon chiefly. Indeed, the former has so recently been fixed upon with any uniformity that the essential end results cannot be calculated. Fortunately, the time is approaching when definite conclusions can be drawn.

The difficulties attendant upon a solution of the best methods for the treatment of gastric ulcer are great. The uncertainty of its clinical course renders statistics concerning therapy most confusing and often unreliable. It is often present without symptoms; its most active manifestations may be followed by a period of quiescence; it may recur at varying intervals; it may remain a mild disease, large groups being attended by minimum mortality; or it may be a grave affection, vicious to the extreme.² There is, or

¹ An address delivered at the Seventh Triennial Congress of American Physicians and Surgeons, Washington, D. C., May 7, 8, and 9, 1907.

² A physician of large experience in hospital and private practice, writes that he has never seen a death from gastric ulcer and never sent a patient to a surgeon. His experience of gastric ulcer was not large, it is fair to say.

may be, ever present, that general nervous state or nutritional fault which precedes, attends, and therefore invites recurrence of ulcer.

In a general way the methods of treatment are either medical or surgical. At least it has been forced on the minds of the profession that gastric ulcer must be considered either a medical or a surgical disease. This attitude is such that, notwithstanding the protests of good surgeons, cases are forced upon them for operation when it would be unjustifiable to operate.

To combat this notion it seems necessary to assume that there are two forms of treatment; to demonstrate if possible their relative values; to show that each has a field and also in which field the respective methods apply. In one sense no comparison can be made. Gastric ulcer has two phases: one of simple course, the other with complications. These are the divisions held to in this paper—simple ulcer and ulcer with complications. The simple and the complicated phase have an entirely different clinical expression, although both are liable to the accidents of hemorrhage and perforation. The former, barring accidents, we hope to show, is a medical, the latter a surgical, affection.

Any form of successful treatment should lower the mortality of the disease, should aim to cure it so thoroughly that, as far as can be said, the ulcer is healed and that danger of relapse is not likely to occur, and that the patient is in as good condition relatively as before the onset of the affection. Any procedure which brings about such an ideal condition is of course the one to adopt. It is the purpose of the statistics which follow to show which form may more nearly attain this end. The problem is rendered difficult because the disease is not common and the experience of individual observers is small.

THE CRITERIA OF CURE. What constitutes a cure? The statistics of gastric ulcer show that most observers consider the disease cured when, after three or four weeks of treatment, the symptoms are relieved or removed. This is unfortunate. No value can be attached to cases reported in such manner. It is well known that at varying intervals after an alleged cure, perforation or hemorrhage may occur. To establish criteria on which to base a cure is difficult. It would seem that a lapse of two years without symptoms, that an approach at least to normal chemical conditions, and a removal of all abnormal physical or mechanical states are sufficient grounds to affirm that a cure has taken place in simple ulcer. To these some authorities would add the absence of occult blood from the stools for a long period. After a course of treatment by any means, notwithstanding these precautions, it is difficult to say that a cure has been obtained unless all the above conditions have been fulfilled.

THE ADVANTAGES OF MEDICAL TREATMENT. The two forms of treatment held out to us have advantages and disadvantages.

By the medical treatment the functional derangements, causal and secondary, are managed. It is conducted without doing violence to the body in any way, and if successful leaves the subject in as good condition as before.

THE DANGERS OF MEDICAL TREATMENT. A sense of false security is given, as the ulcer may be dormant and an accidental and fatal complication may arise when one is not prepared for it. The freedom from symptoms may flatter the patient that a cure has been established and induce carelessness in dietetics, hygiene, etc. Further, the healing of the ulcer, also possible under surgical treatment, may be attended by grave sequels of adhesions, contractions, or stenosis.

THE ADVANTAGES OF SURGICAL TREATMENT. By the surgical treatment, if indicated, the advantages of the medicinal treatment are secured. The operation is too often held to be the panacea, when success is really due to the after-cure. There is no reason why a patient who has undergone surgical treatment should not have an after-treatment like that which is given to cure the tendency to ulcer. The advantages depend upon the nature of the operation and the ability to deal with the complications. If the operation of excision is resorted to, the symptoms and accidents are prevented, providing, of course, there is only one ulcer. The gastro-enterostomy now in vogue is a procedure which while it relieves the many symptoms, does not warrant the belief that a cure is established. It is not proved that the ulcer has healed. Both perforation and hemorrhage occur after gastro-enterostomy. It is not known that relapse or recurrence is less frequent than in ulcers treated medically. The splendid statistics of Robson and of Mayo in their end-results compare favorably with, but are not better than, similar statistics of men who have treated similar groups of cases medically. The time element in the surgical cases is the unsettled factor. If the ulcer is excised, a dangerous and not practical procedure we are told, or destroyed by perforation, the only risk comes from persistence of the organic cause or the presence of two or more ulcers. In the second period of ulceration, when complications have arisen, the advantages are entirely in favor of surgery.

THE DANGERS OF SURGICAL TREATMENT. (1) The same as in the medical treatment unless excision of the ulcer, if solitary, is resorted to. (2) Operative death. (3) Death from complications. (4) Death or ill health from defects in metabolism. (5) The effect of the operation. The patient on whom an operation has been performed has the disadvantage of a psychic insult, the influence of which is not trifling, and of being in possession of new physical and physiological conditions the nature of which time alone can tell. It must be admitted that a patient who has undergone a grave surgical operation is not in as good condition to have that indefinable some-

thing, which may be termed neurosis, cured, as he who has not been submitted to such an insult.

The surgical dangers are constantly lessening. From an average operative mortality of 20 per cent. they have fallen to 1.5 to 2 per cent. for individual operators, and 10 per cent. for all. The tables will show a remarkable change born of experience in technique between the operative results of all prominent operators in their first and their latest series. Thus the vicious circle is rarely established and in the latest large group of cases of the Mayos, Moynihan, Robson, Deaver, and others it did not occur. Peptic jejunal ulcer is also a less frequent complication. (See Lyle and Joslin.)

Hunsheimer, Joslin, Rosenberg, Kreuger, and others have studied the effects of gastro-enterostomy on metabolism and on gastric secretion. The studies are not sufficient as to the metabolism, although most suggestive. More studies must be made also of the chemical secretions. Kreuzer's² are the most recent.

The after-effects of gastro-enterostomy are, he states: (1) Secretory function again assumes the normal condition. (2) Total acidity falls to the normal—sometimes below, but rises shortly to the normal. If the acidity was above normal before operation it sinks otherwise to normal. If acidity was diminished the usual rule is for it to reach normal or slightly above. (3) Free hydrochloric acid—usually lessened after operation. (4) In those cases in which no trace of hydrochloric acid is found, it is obtainable after the operation, the exception being to find it missing. A deficient hydrochloric acid cannot be considered a disadvantage, as it is only a result of increased emptying power of the stomach. (5) The backflow of bile into the stomach disappears gradually and does not seem to cause any pronounced symptoms. (6) Backflow of pancreatic juice is seldom recognizable. Complete blocking of the outflow seems to be more the result of the disease than of the operation.

Katzenstein studied the question experimentally and compels us to assume that the secretory, in addition to the motor, function is benefited by operation. Not only did he find that the backflow of bile and pancreatic juice lowered the acidity because of this alkalinity, but also that the delicate reflexes of the duodenum and jejunum were not lost, if the animal was fed on special foods, as fats.

The experimental evidence does not forbid surgical procedures, apparently.

A STUDY OF STATISTICS. To one who has had the opportunity of studying only some sixty odd cases of gastric ulcer, the wisdom that comes from personal experience cannot be overwhelming. The study here presented is based, therefore, on an analysis of 1871

² Effects of Gastro-enterostomy on the Chemical Functions of the Stomach, 1906.

cases of gastric ulcer and 316 cases of duodenal ulcer collected from the accumulated literature since 1897.⁴ The cases selected are those only which have been reported in full detail.

The German and French cases⁵ were tabulated in accordance with the following scheme: (1) Age. (2) Sex. (3) Hemorrhage. (4) Pain. (5) Vomiting. (6) Boas' tender points. (7) Acidity. (8) Feces. (9) Retention. (10) Duration of diseases. (11) Medical treatment. (12) Result. (13) Surgical treatment. (14) Result. (15) Length of period under observation after treatment. (16) Recurrence. (17) Remarks. (18) Observer.

The English and American cases, on the other hand, have been analyzed to determine the incidence of age and sex; the basis for diagnosis according to symptoms and gastric analyses; the occurrence of retention from simple dilatation, pyloric spasm, adhesions, hour-glass contraction, or pyloric obstruction; the duration of the disease; the medical treatment, if any, and the result; the surgical treatment, if any, and the result; the duration of relief; and recurrence. The question of hyperacidity or hyperchlorhydria was, through an oversight, omitted. This is to be regretted, as the division of ulcers into those with secretory symptoms and those with motor symptoms should be clearly defined. Fortunately the answers to the various questions are such that in a general way this question has been satisfactorily met.

In addition a study of 586 cases has been made, based upon private communications received in reply to a letter to members of the Association of American Physicians which requested an answer which would supply the above facts. I scarcely need say I am deeply indebted for the valuable contributions thus placed at my disposal.⁶

I have kept apart from my tables and used as control, for analysis and comparison, the unique and unparalleled experience of the Mayos and of Robson, Moynihan, Munro, v. Mikulicz, and many others, as well as of the distinguished gentlemen who took part in the discussions of the Royal Medical and Chirurgical Society in 1906. No papers on gastric ulcer can be written without drawing fully on the older writings and the not remote ones of Welch, Fenwick, Lebert, Dreschfeld, Brinton, and others.

To control the errors liable to occur in statistics, comparisons have also been made with the conclusions of the various able writers who have analyzed large groups of cases. The skilful analyses of Wier and Ford, Rodman, Patterson, Caird, Russell, Bramwell, Greenough and Joslin; of Lund, Joslin and Murphy; of Sears,

⁴ The cases of duodenal ulcer have been reserved for a future communication.

⁵ Over 900 cures. Treatment only is analyzed in this communication.

⁶ Since this has been written, valuable private communications with lists of cases have been sent me by Deaver and others. They will be embodied in an analysis to be published in the future.

Campbell Howard, Thompson, and others are invaluable. The German and French theses and the papers of Brunner, Krenzer, Krönlein, Körte, v. Mikulicz, Minkowski, Blumensath, Spicker, Schneider, Becker, Ladevèze, and Rochard have also been excellent controls.

The well-founded objection that statistics which give the results of treatment are usually exaggerated, whether surgical or medical, because the tendency to omit failures is dominant, has been borne in mind. It does not appear, however, that there is any way of bringing together a large number of cases except by this means.

The statistics offered by the advocates of medical treatment do not fully prove their case. A better brief could have been made by them had the cases been reported in greater detail and especially, also, with more precise accounts of after-results. It must be said in this respect that the surgeons have their cases better in hand for continued observation. This has grown out of the necessity before them of continually proving the contention that their invasion of the sphere of medicine is warranted by results. The quarrel as to the respective merits of the medical and the surgical treatment of appendicitis would be in continuance had the surgeons not been able to marshal their facts to telling purpose. Then, too, the responsibility of taking the life of the patient in their hands adds to the necessity of scientific precision of knowledge instead of glittering generalities.

The study of statistics impresses one with the value of having a single guiding head and hand for each department of a hospital and of a liberal management which will employ such aid as can enable the staff properly to collect records and to keep in touch with patients after their discharge. An efficient medical secretary is as essential as a good nurse in any institution. Only by these means can fruitful observation be secured. Moreover, although it places another burden on the practitioner, if he wishes to attain knowledge that can be applied to his daily work, he must similarly keep in touch with patients after their discharge.

As previously intimated statistics are thus far not reliable, and can only admit of approximate conclusions because no established criteria have been formed for a basis of calculation. They are meagre because the patients are lost sight of. From the studies of the many cases in the literature I should say we need information of the end-results and the course of the disease during a period of ten years. We should agree upon what constitutes a "cure." All realize the difficulties, whether it is to base the result on the duration of relief of symptoms and the absence of physical sequels, or on the plan of Boas, to affirm a cure only when occult blood (in addition to the above) is absent from the stools.

The study has not been satisfactory, for the reasons above mentioned. It has been profitable because it has laid bare our defi-

ciencies. Many points of interest, however, are brought out, and the province of the physician and the surgeon defined.

Some elementary facts obtained from a study of the statistics of gastric ulcer must be known in order to estimate the relative merits of remedial measures. We should have a clear notion of the frequency of gastric ulcer, of the mortality of the disease irrespective of treatment, and of the mortality following the surgical and the medical treatment of the affection.

THE FREQUENCY OF GASTRIC ULCER. The infrequency of gastric ulcer, as the following statistics will show, behooves us to pause before urging operative procedures for intractable indigestion, hematemesis, gastric pain, and other isolated symptoms on the ground that they are of ulcer origin. I am willing to admit that an exploratory operation in competent hands is attended by very little danger. If the surgeon wishes to coddle his mental powers by employing this means of diagnosis and the patient is willing to submit, nothing more need be said. Otherwise, gastric ulcer will not be considered a frequent surgical affection. This is surely the case in simple ulcer. It would be infrequent in complicated ulcer, if the simple ulcer were treated for a sufficiently long period of time.

FREQUENCY OF GASTRIC ULCER BASED ON AUTOPSIES.

Author.	Number of autopsies.	Number of gastric ulcers.	Per cent
Welch (German statistics)	32,052	1522	5.00
Dietrich	10,103	350	3.40
Fenwick	47,912	2019	4.20
Harlow Brooks (Bellevue Hospital) . .	1,000	9	0.90
Pearce (Albany Hospital)	1,000	11	1.10
Welch (Bellevue Hospital)	800	6	0.75
Willigde	3,400	221	0.64
Howard (Hospitals of United States) . .	10,841	144	1.32
Francine (Philadelphia and Phipps) . .	2,937	41	0.13
German Hospital (A. O. J. Kelly) . . .	937	(duod. & gastric)	0.13
Mallory (Boston City Hospital)	(11 years) 2,600		
Warthin	200	7	0.35
Schneider (Munich)	1895-1899 4,535	89	1.92

Howard, in a valuable paper pointed out that the frequency of ulcer varies in different cities. Based on clinical returns he found the largest percentage of cases in Boston—1.28; the smallest number in Denver—0.12. The Boston statistics tallied well with the figures of Greenough and Joslin from the Massachusetts General Hospital, where a percentage of 1.74 was found. It is of interest to note that in Breslau and Zurich 0.66 per cent., London 0.78 per cent.,

Berlin 1.33 per cent., Edinburgh 2.2 per cent., are fair estimates of the clinical frequency of gastric ulcer. The percentage of frequency in America is greater than that in Germany and London. Edinburgh is higher than America or London.

FREQUENCY OF GASTRIC ULCER BASED ON CLINICAL OBSERVATION.

Author.	Number of cases.	Number of gastric cases	Number of cases of ulcers	Private practice	Per cent.
Lebert	41,688	.	252	.	0.6100
Charité Hospital, Berlin, } 1885-1895	42,219	..	555	..	1.3200
Howard*	(Med. adm.) 161,599	...	930		0.5700
Fenwick †	{ (Med adm), 45,712 { Out-patients, 5,090	.	283 37	.	0.6200 0.7100
Bramwell ‡	{ In-patients, 35,692 { Out-patients, 7,065	..	803 76		2.2000 0.0900
Medical Service of Bellevue } Hospital, Harlow Brooks }	In 3 months, 6,205	.	3		0.0010
Berlin Charité	{ 1901-01, 15,811 { 1901-05, 15,863	250 279	16 18		0.0022 0.0070
Clayton §	1,569	168	8		0.0010
El-sner	1,000	171	11	Private.	1.5000
Ingers	2,105	550	7	Private.	0.0030
Liehty	6,870	1,269	103	Private	1.0000
Friedenwald	13,791		287	Private.	2.0000
Sawyer . . . . .	....	1,800	63	Private.	

*Hospitals of United States (15). †London and Temperance Hospitals. ‡Edinburgh Royal Infirmary. §Garfield Hospital.

The variation in statistics in hospitals of the same city is due to the different class of patients admitted to the respective hospitals. It is well known that the death rate and frequency are higher in Guy's Hospital in London than in other hospitals, because of the poor class of patients admitted to the former.

In private communications received from physicians throughout the country the reports of the infrequency of gastric ulcer in the cities mentioned above is confirmed. It must not be forgotten, however, that different observers have different criteria upon which the diagnosis of ulcer is based. Thus Howard states that the disease is rare in Baltimore, whereas Friedenwald reports an unusually high percentage. Professor Baumgarten in St. Louis writes that it is very infrequent and that he has never had to send a case to a surgeon.

THE MORTALITY. The mortality of gastric ulcer varies with different observers, as the tables indicate.⁷ Irrespective of the

⁷ With a view to economy of space, many of the tables are omitted. Those especially interested in them will find them in detail in the *Trans. Cong. Amer. Phys. and Surgeons*, 1907, p. 56.

method of treatment the mortality of patients admitted to the hospital seems to be from 6 to 8 per cent., although Bulstrode places it as high as 18 per cent., Gilman Thompson at 20.5 per cent., and Körte and Herzfeld at 25.9 per cent. In private practice the mortality is much less, as the cases of Friedenwald, Lichty, and others show.

PERCENTAGES OF SIMPLE ULCER, SEQUELS, HEMORRHAGE, AND PERFORATION IN CASES COLLECTED FROM LITERATURE. Total number of cases 1871: Simple ulcer⁸ 409 (21 per cent.); perforation, 536 (28.1 per cent.); hemorrhage,⁹ 160 (8.01 per cent.); of sequels 766 (40.01 per cent.). The number of reported cases of simple ulcer included in the analysis is undoubtedly very small. As no special interest is attached to single cases treated medically, they are not reported. Moreover, the proportion of cases is not true. Thus, cases of perforation have been reported more frequently of late, to clear up questions of diagnosis and settle modes of surgical technique. The unpublished cases from private practice give a truer idea of the relations of the simple and the complicated ulcer and the frequency of the grave accidents in various forms:

PERCENTAGES OF SIMPLE ULCER, SEQUELS, HEMORRHAGE, AND PERFORATION IN UNPUBLISHED CASES. Total number of cases, 586. Simple ulcer, 194 (33.1 per cent.); hemorrhage (grave), 23 (3.9 per cent.); perforation, 16 (2.7 per cent.); sequels, 353 (60.2 per cent.).

SIMPLE ULCER. The results of the treatment of simple ulcer in cases collected from the literature is shown in the following table:

Simple uncomplicated ulcer. 409 cases		21.0 per cent.
Cure and improvement		76.0 "
Male 143 34.9 p. c.	Unimproved	6.6 "
Female 266 65.1 "	Death	17.3 "
Immediate result. Surgical treatment,	Cure 184	68.1 p. c. }
	Improved 41	5.1 " }
	Unimproved 18	6.6 " }
	Death 54	20.0 " }
Immediate result. Medical,	Cure 102	73.3 " }
	Improved 11	7.9 " }
	Unimproved 9	6.4 " }
	Death 17	12.4 " }

The mortality is 17.3 per cent. It is seen that the advantage is in favor of medical treatment, as the immediate result from such treatment is attended by a mortality of 12.4 per cent., while by surgical treatment it is 20 per cent. We must admit, physician and surgeon alike, that simple uncomplicated ulcer is a medical disease.

This table does not include the statistics of Leube, Lichty, and many others. Hemorrhage and perforation cases are not included.

⁸ Without serious hemorrhage or sequels.

⁹ Demanding treatment

Thus, Leube and Friedenwald have, and Bramwell, Schultz and Robinson estimate, a mortality below 6 per cent. Without doubt the excellent results attained in private practice are explained by the fact that the patients apply early for treatment, at once are placed on a proper dietary, and medical supervision is continued for a long time. It must be remembered that hospital patients, presumably the poorer classes, have more frequent complications and sequels and a higher mortality than private patients. This occurs because the former class cannot carry out treatment for a sufficiently long time, and, indeed, usually give it up as soon as symptoms are relieved.

The results of the treatment of simple ulcer in private practice are shown in the following table (unpublished cases):

Simple ulcer. Total number of cases		194		
Male		56	25.9 per cent.	
Female		138	71.1	"
35 Surgical treatment	18.0 per ct.	Cure . . .	85.70 per ct.	Unimp. . . 14.3 per ct.
159 Medical treatment	82.0 "	Cure . . .	91.70 "	Unimp. . . 08.3 "
As to decade of surgical treatment, most cases between 20-30.				
		48.5 per ct.	Men . . .	29.49 per ct.
Of these cure . . .		91.1 "	Men . . .	29.40 "
unimp. . .		05.9 "	Women . .	100.00 " (one case).
As to decade of medical treatment most cases between 20-30.				
		48.4 per ct.	Men . . .	20.50 per ct.
Of these cure . . .		91.0 "	Men . . .	17.90 "
unimp. . .		09.0 "	Men . . .	23.50 "
			Women . .	79.5 per ct.
			Women . .	82.1 "
			Women . .	71.5 "

A closer analysis shows that of the 85.7 per cent. that were noted as cured by surgical treatment, 77.1 per cent. were reported as cured finally and 8.5 per cent. improved. Of the 14.3 per cent. unimproved, 11.4 per cent. died. 91.7 per cent. were reported as cured by medical means, of which 60.1 per cent. were cured absolutely and 32 per cent. improved. 5 per cent. of the unimproved remained ill and 3.1 per cent. died.

The death rate in simple uncomplicated ulcer treated surgically is higher (11.4 per cent.) than the death rate of cases treated medically (3.1 per cent.). It must be observed, however, that a larger number were reported "improved," after medical treatment, the end of which is not known, than after surgical treatment.

A study of the 270 cases of simple ulcer treated surgically shows that the patients came to the surgeon after the thirtieth year and the larger proportion in the decade from 40 to 50. Male subjects deferred treatment to a later period than females.

Cases are treated medically in the earlier decades. They are in all probability uncomplicated. The surgeon is brought to the complicated cases. Either one of two things is evident: cases are not sufficiently grave to undergo treatment, or medical treatment is

not conducted as vigorously and over as long a period of time as is required to bring about a cure. It is more likely that the early symptoms were absent, mild, or overlooked and treatment was not needed until organic conditions developed. In private cases the surgical treatment was instituted with the same relative degree of frequency as the medical in the corresponding decades. The tables show that the reported or hospital patients (poorer classes) delay treatment and that the more severe cases go to the surgeon. In private practice there is not the same delay.

In simple ulcer the death rate under surgical treatment was 20 per cent., and under medical treatment 12.4 per cent. Privately reported cases showed a surgical mortality of 11.4 per cent. and a medical mortality of 3.1 per cent. It is not easy to compare these statistics with others, for in other analyses the mortality is given of both simple and complicated ulcer when not due to hemorrhage or perforation. The results of the medical treatment of peptic ulcer in the Boston City Hospital as reported by Sears showed a mortality of 21 per cent. Greenough and Joslin in a study of 187 cases, treated in the Massachusetts General Hospital, found the mortality was 8 per cent. It must be noted that only 40 per cent. of the 82 per cent. discharged cured or relieved remained well. The series which Shultz analyzed from the Breslau and New Hamburg Hospital gave a mortality of 5.4 per cent., or if unrelieved and died are added, 10.5 per cent. unimproved by treatment. Sears well points out that the longer cases are followed the higher the proportion of failures, rising at the end of five years to 50 per cent. Unfortunately neither surgical nor medical cases have been observed over the length of period that permits of definite conclusions. Gradually there comes to light more and more cases in which repeated operations were done, indicating failure by surgical as well as by medical means. Hewes reports a series of cases of simple ulcer which more nearly correspond to our groups. Of 51 cases immediate results with complete relief followed medical treatment in 48; failure in relief of symptoms, 2; died, 1. 49 of the 51 were followed for a period of two years with results as follows: 31, or 63 per cent., cured; 18, or 36 per cent., recurred; 1, or 2 per cent., died. The same class of cases treated surgically, 13 in number, resulted as follows: cured 6, or 46 per cent.; recurred or not relieved by operation 3, or 23 per cent.; died shortly after operation 4, or 30 per cent. A separation of the cases into the simple and complicated cases was not made in B. Robinson's cases (mortality 2.1 per cent.); in Bramwell's (mortality 6.2 per cent.); in Russel's (mortality 2.1 per cent.); and von Leube's (mortality 2.4 per cent.); all of which were treated medically. Had such been the case the mortality for the management of simple ulcer would have been less without doubt.

REMOTE RESULTS OF THE SURGICAL AND THE MEDICAL TREATMENT OF SIMPLE ULCER (LITERATURE).

Period.	<i>Simple Ulcer, Medical.</i>				<i>Simple Ulcer, Surgical.</i>			
	Cure.	Imp.	Unimp.	Death.	Cure.	Imp.	Unimp.	Death.
6 months	20	10	2	11	36	5	4	47
6-12 months	3	0	0	0	28	1	0	0
1-2 years	0	0	0	0	43	0	0	0
2-3 years	0	0	0	0	6	0	0	0
3-4 years	1	0	0	0	12	1	0	0
4-5 years	0	0	0	0	1	1	0	0
5 years	1	0	0	0	4	0	0	0
Not given	85	..	5	...	..	109	4	..

This table shows the result from six months to five years after treatment. It shows also the unsatisfactory state of the literature, inasmuch as end results are disregarded by surgeons and clinicians alike. Nevertheless, of 270 cases treated surgically, presumably cured, 47 were dead at the end of six months, while of the 139 treated medically 11 died in the first six months.

REMOTE RESULTS OF THE MEDICAL AND THE SURGICAL TREATMENT OF SIMPLE ULCER (UNPUBLISHED CASES).

Period.	<i>Medical.</i>				<i>Surgical.</i>			
	Cured.	Imp.	Unimp.	Death.	Cured.	Imp.	Unimp.	Death.
1-6 months	6	6	1	5	2	..	..	4
6-12 months	9	3	..	..	2	..	..	..
1-2 years	4	2	..	..	..	..	..	..
2-3 years	7	..	..	..	..	..	..	..
3-4 years	..	1	..	..	..	..	..	..
4-5 years	..	..	..	..	..	..	..	..
Over 5 years	1	..	..	..	..	..	..	..
Not given	58	36	6	..	18	..	..	..

Recurrence noted in 2 cases.

In addition to the foregoing the records show 35 cases apparently cured but followed by recurrences. Of these 29 showed benefit after further treatment. Of the cases treated medically recurrence was noted in 16 apparent cures. Although the period of observation was not given, all but 14 were observed for periods extending beyond six months.

The remote results of the treatment in simple gastric ulcer are determined with difficulty, inasmuch as most of the cases analyzed again are not divided into simple and complicated. Mayo Robson had followed patients for from one to five years and was able to find 96 out of 112 who had suffered from gastric ulcer, for whom he had operated, in good health. Unfortunately his cases are not classified as to sequels. The same may be said of the studies of Greenough and Joslin, Russel, Debove, Murdock, and others. It is proper to note that many insist that the remote results of ulcer (with and without complications) treated medically are most unsatisfactory—56 per cent. of the 55 per cent. who were discharged from the Massachusetts General Hospital (Greenough and Joslin)

were dead or suffered from recurrence after the lapse of five years. Five hundred patients suffering from gastric ulcer were admitted to the London Hospital, 42 per cent. of whom had previous attacks. Bulstrode, who made the analyses, states that 82 per cent. were discharged, relieved or cured, but concludes, if the large percentage noted above had recurrences, similar recurrences must have occurred in the 82 per cent. It is Mayo Robson's conviction that 25 per cent. of all cases of ulcer of the stomach treated medically succumb to the disease or its complications. Unfortunately, again we are without the divisions of the simple and the complicated ulcer. Debove and Remond estimate the mortality at 50 per cent.

In this connection the careful analysis of Russel of the results of the treatment of 47 patients (no division) should be given: after a lapse of from two to thirteen years, the direct mortality amounted to 2.1 per cent.; 42.6 per cent. ended in recovery; 4.3 per cent. died from intercurrent disease; 6.4 per cent. could not be classified; and 44.7 per cent. were suffering from stomach symptoms. Hawkins, in a study of 536 cases, admitted to St. Thomas' Hospital, found the mortality 13.3 per cent., of which 0.9 per cent. died of hemorrhage, 8.5 per cent. of general, and 1.9 per cent. of local peritonitis. Adhesions and pyloric stenosis caused the death of 1.9 per cent. Patterson reports 99 cases cured; 9 result fairly good, and 8 unsatisfactory (4 died and 4 relapse) in 116 gastro-enterostomies, after a lapse of eighteen months to nineteen years. Again there is no statement of the sequels, as in the following list treated medically, which in 72 cases resulted in 19 cures, 2 probable cures, 5 probably not cured, and 46 not cured. Only 7 of the 19 remained free from symptoms. Von Leube's 556 cases gave a mortality of 2.4 per cent.; cure, 74.1 per cent.; improved, 21.9 per cent., and unimproved 1.6 per cent. Huberman reports recurrence in 20 per cent. of 100 cases cured by ordinary medical treatment, and 8 per cent. of recurrence when the Lenhartz treatment was employed in 135 cases.

The opinion of most writers is that the medical treatment of simple gastric ulcer is attended by the best results, whether the outcome immediate or remote is considered, and the quoted statistics appear to uphold this contention.

THE TREATMENT OF HEMORRHAGE. The subjoined tables are an analysis of the cases which were treated, because life was in peril, specifically for hemorrhage. Our statistics support the observations of those who admit that hemorrhage is best treated medically, but under many circumstances an operation is justifiable. Hemorrhage occurred in 160 of the 1871 cases collected from the literature.

Majority of cases between 20-30, women.

	Per cent.
I. 135 acute cases	53.2
77 were treated surgically	57.1
of these cure	41 53.2
death	33 42.8
not given	3 4.0
58 were treated medically	42.0
of these cure	36 62.0
improved	6 10.3
unimproved	0
death	13 22.4
not given	3 5.3
II. 25 chronic cases	15.7
18 were treated surgically	72.0
of these cure	14 77.6
improved	0
unimproved	0
death	4 22.4
7 were treated medically	28.0
of these cure	1 14.3
improved	
unimproved	
death	2 28.5
Result not given	3 42.8
One case treated and died.	
Hemorrhage occurred in 23 of the 536 (3.9 per cent.) remote cases.	
I. Acute	20 86.0
Surgical cases	7 35.0
of these cure	4 42.8
improved	1 14.3
death	3 42.8
Medical cases	13 65.0
of these cure	10 76.0
improved	0
unimproved	0
death	3 23.1
II. Chronic	3 13.1
Medical cures	2
Surgical cures	1

The occurrence of hemorrhage in the course of gastric ulcer is placed at figures ranging from 50 per cent. to 80 per cent. of all cases. The figures include those which are small in amount, infrequent or single, and those of very frequent occurrence, multiple, and in which large amounts of blood are lost. Treatment is not necessary in many cases. In the other cases medical measures are resorted to. When life is in peril because of frequent small bleedings or because of one or more large hemorrhages putting life in peril, surgical measures have recently been considered. It is the consensus of opinion that hemorrhage is usually controlled by well-established lines of procedures. Can the few be saved by persistence in medical measures or by resort to surgery? Our statistics uphold the contention that acute large hemorrhage treated by medical means is attended by less mortality than that which is treated by

surgical means; the percentage of death after medical treatment is 22.4, and after surgical treatment, 42.8. Of course, the cases have been those in which life was in peril, desperate from the beginning, and perhaps an unfair class for the surgeon. It is presumed that the question with each surgeon was one of operation in the face of death. In the unpublished cases the percentage of hemorrhage, of some types, was small and hence there are only a few upon which to base a calculation. The mortality in the respective divisions is about that given above—medical, 23.1 per cent.; surgical treatment, 42.8 per cent.

The mortality of hemorrhage when medical means are employed is given as follows: Becker, 17.2 per cent.; Brinton, Gerhard, and Welsh, 3.5 per cent.; Diller, 10 per cent.; v. Leube and Ewald, 1.125 per cent.

The remarkable experience of Moynihan stands out as an encouraging feature. This surgeon saved 19 out of 22 patients. Connell, in a paper published in 1905, finds a lessening of mortality, as follows: Marion (1897), 66 per cent.; Hartmann, (1898), 51.6 per cent.; Bidwell (1899), 50 per cent.; Robson (1900), 53.8 per cent. Rodman's analysis showed a mortality of 40 per cent., and Connell, in an analysis of 100 cases, found a reduction of the mortality in 57 acute cases to 26.3 per cent.

Chronic bleeding ulcer, leading to grave anemia, is cured by surgical measures, according to our analysis, more frequently than by medical means. The mortality surgically is 22.4 per cent.; medically, 28.5 per cent. In private practice, the cases are too few for analysis. The mortality of Robson's cases (1900) is 10.5 per cent.; of these analyzed by Rodman (1900), 19.3 per cent., and by Connell (1904), 8.5 per cent.

An analysis of the two classes of cases as to age and sex did not, as the tables show, reveal that either of these states predisposed to success or failure in any line of treatment. Greenough and Joslin note a mortality of 17 per cent. in males and 1.2 per cent. in females.

The individual operator stands out. The person of experience tallies higher than the group of operators of small experience. The conclusions seem warranted that the patient is in safer hands by medical treatment, unless he can have the services of a surgeon of large experience. Even then, in acute hemorrhage, unless life is despaired of, the surgeon prefers to postpone operation until the hemorrhage is controlled and the patient relieved of shock and acute anemia.

TREATMENT OF PERFORATION. The treatment of perforation has been discussed very exhaustively during the last ten years. The improved abdominal technique has led to remarkable successes in this field.

INCIDENTS OF PERFORATION (LITERATURE).

		Total No. of cases, 1871.	
Perforation 536 (28.1 per cent.).		Male	191
		Female	334
		Not given	11
		Sex	
Age	1-10	3	
	10-20	95	
	20-30	217	
	30-40	90	
	40-50	51	Operations for perforation 481
	50-60	29	Not operated 55
	60-70	10	
Age not stated	Over 70	5	536
		36	

INTERVAL BETWEEN PERFORATION AND OPERATION.

Number of hours.																Not given, acute.		Not given, chronic.	
1-12	12-24	24-48	36-48	over 48	1 wk.	1-2 w.	2-3 w.	3-4 w.	over 4	53									
*C D	C D	C D	C D	C D	C D	C D	C D	C D	C D	C D	C D	C D	C D	C D	C D	C D	C D	C D	C D
144 38	73 43	21 12	8 17	3 19	12 4	4 4	0 1	1 1	...	...	17 4	32 26	1 1						
182	116	33	25	22	16	4	2				21	No op.	2						
Acute.										Subacute and chronic.									

* C, cured; D, died; I, improved; U, unimproved.

TREATMENT OF PERFORATION. LITERATURE. 536 CASES. In 481 operations—89 per cent. Cured 65.7 per cent. Died 34.3 per cent. In 55 without operation—Cured, 11 (20 per cent.); died, 30 (54.5 per cent.); not stated, 14. Sex: Male, 191 (35.6 per cent.); female, 334 (62.3 per cent.); not given, 11 (2.1 per cent.).

The majority of perforations occurred in females between the ages of twenty to thirty—201 cases: 142 women; 59 men.

The best percentage of cures was noted when operation was between one to twelve hours after perforation.

In cases of third decade—Cure, 135 (67.1 per cent.); women, 92 (68.1 per cent.); men, 44 (31.9 per cent.). Unimproved, 66 (32.9 per cent.); women, 51 (77.2 per cent.); men, 15 (22.9 per cent.).

In the same decade the medical treatment was as follows: 14 cases—11 women, 3 men; of these—cured 4 (28.5 per cent.), all women. Unimproved, 10 (71.5 per cent.); women, 7 (70 per cent.); men, 3 (30 per cent.).

PERFORATION. Cases Collected from the Literature. Period of observation after recovery from operation for perforation during which time patients remained well: one to six months, 93; six to twelve months, 38; one to two years, 13; two to three years, 14; three to four years, 3; four to five years, 3; five to ten years, 5; not stated, 131. Total number of cases of perforation, 536; total number of permanent benefit ranging up to ten years, 300.

Recurrence. After six months, none; after one year, 2; after two years, 1; after three years, none; after four years, 1; after five years, none; not stated, 1. Benefit, but later recurrence, 5.

Unpublished Cases. Number of cases, 16 (2.7 per cent.). Sex: male, 7 (42.7 per cent.); female, 9 (56.3 per cent.). Age: ten to twenty, 1; twenty to thirty, 4; thirty to forty, 6; forty to fifty, 3; fifty to sixty, 1. Time between perforation and operation not stated. Cured, 5 (31.2 per cent.); died, 11 (68.8 per cent.).

Perforation spares neither age nor sex, occurring in about the same degree of frequency that ulcer occurs in each sex and in the respective decades. Apparently it is a slightly more frequent accident in males. Contrary to the experience in hemorrhage, age is an influence which counts for or against special lines of treatment. It would be expected that in the extremes of life the mortality would be higher, with or without operation, than in the middle periods. Sex does not appear to have such influence.

The mortality of perforation as given by four observers is about as follows: With operation: Moynihan, 33.3 per cent.; Hawkins, 43 per cent.; Brunner, 48 per cent.; Garre, 30 per cent. Without operation: Brunner, 95 per cent.

Operation was resorted to in 481 of the 536 cases with a mortality of 34.3 per cent.; cures, 65.7 per cent. 55 cases were not operated on, death taking place in 54.5 per cent. of the cases. 20 per cent. of the 55 were cured and the result not given in the remainder of the percentage. In the unpublished or private cases 31.2 per cent. were cured by operation, and 68.8 per cent. died.

Great interest is attached to the time interval between the accident and the operation. The analysis shows, in consonance with that of others, that the shorter the interval the higher the percentage of cures. Weir and Foote and afterward Keen¹⁰ analyzed reported cases, and Robson and Moynihan and Caird presented individual experience. The figures below give the percentage of death:

Weir and Foote.		Keene.
	Per cent.	Per cent.
Under 12 hours	39.13	19.23
12 to 24 hours	63.63	50.80
24 to 48 hours	77.77	55.55
Over 48 hours	57.51	25.31
Caird.		Robson and Moynihan.
	Per cent.	Per cent.
Under 12 hours	5 cases, 40	49 cases, 28.5
12 to 24 hours	8 cases, 37.5	35 cases, 63.6
24 to 36 hours	3 cases, 33.3	14 cases, 87.5
36 to 50 hours	2 cases, 50	2 cases, 100.0

Goldsincker, in a summary of 250 articles, finds a mortality of 50 per cent., and in 236 cases 51 per cent. of the persons operated on recovered. Only 46 of the 236 recovered after the twelfth hour. The author calls attention to the occurrence of multiple perforation.

¹⁰ Cartwright Lectures.

It follows that skill in early recognition is essential to give the patient as well as the surgeon a chance. The medical attendant who recognizes the accident and calls the surgeon early is more deserving of honor than the operator, remarks a distinguished German surgeon.

It is important to note that the operation for perforation is followed by more substantial cures than any other procedure, that is, a permanent cure, hence fewer recurrences follow. French (St. Mary's Hospital) reports 30 cases operated on for perforation, 18 of which were followed many years, and 15 remained perfectly well. Gosh (St. Bartholomew's) notes 69 perforations—34 died—mortality, 49.2 per cent.; 11 operated on and 9 perfectly cured. Patterson's statistics do not fully uphold this view and show the frequency of recurrence after operative procedures in general. 35 patients were operated on for perforation. After fifteen months to two years 18 were perfectly well (16 ulcer closed and 2 closed and gastro-enterostomy). Recurrence took place as follows: 1 died of second perforation twenty-one months later; 2 required gastro-enterostomy; in 9 symptoms of gastric ulcer arose, and 5 had dyspepsia.

If our statistics are upheld it would seem that an operation which destroys the ulcer, as excision, would be ideal. This is the contention of Rydygier, who advocates resection. He lost 2 cases after gastro-enterostomy from perforation and two from hemorrhage and suggests that these complications are not infrequent. Professor Dock, in his Yale address, advocates a similar method of operation, and Bell of Minneapolis is also insistent upon this method, while Rodman earnestly urged excision of the ulcer-bearing area.

THE SEQUELS. In the treatment of the sequels or complications of gastric ulcer the surgeon has equal domain with the physician. The following statistics will show how prominent a surgical affection it becomes, and how necessary it is to employ operative procedures. They show that it is not for gastric ulcer most operations are performed, but for the results of ulceration.

That the sequels of gastric ulcer which cause retention demand surgical treatment our statistics uphold, notwithstanding the opposition of weighty authority. This, however, must be said, the presence, and operation for the relief, of such sequels do not remove the patient from the category of medical supervision. It is as important to continue dietetic, hygienic, and medical means as formerly. Indeed, we must be willing to admit that all surgical procedures must be looked upon as those of necessity.

Cases from the Literature. Number of sequels, 766 (40.0 per cent.). Retention from stenosis, 504 (65.7 per cent.); adhesions, 156 (20.3 per cent.); hour-glass, 81 (10.5 per cent.); dilatation, 13 (1.7 per cent.); pylorospasm, 17 (0.91 per cent.); cause not stated, 5 (0.65 per cent.).

Duration of Symptoms of Sequels:

	Adhesion.	Stenosis.	Dilata- tion.	Pyloro- spasm.	Hour-glass.
1-6 months	4	24	0	2	1
6-12 months	13	46	0	0	8
1-5 years	44	92	4	2	19
5-10 years	46	127	5	1	22
10-15 years.	20	52	2	1	12
15-20 years.	14	43	0	1	9
Over 20 years	9	21	1	0	5
Not stated	6	99	1	0	5

This table shows the duration of symptoms prior to operation. The records in which the maximum number of sequels occurred is given below: Adhesions: Greatest number (43) between ages of 30 to 40 years. More females than males. Stenosis: Greatest number (118) between 30 to 40; more males than females. Hour-glass: Greatest number (22) between 40 to 50; more females than males. Pylorospasm: Three between 40 to 50, all females, and two between 50 to 60, all males. Dilatation: Three between 20 to 30, were females; and three between 40 to 50 were males.

All admit that ulcer is a disease of early life. The above statistics show, as we would expect, that the sequels are of late life. The duration of the symptoms, 5 to 10 years, upholds this. If the ulcer was diagnosticated early and treated properly, the late sequels would be avoided.

THE RESULT OF THE TREATMENT OF SEQUELS (CASES FROM LITERATURE).

	<i>Medical.</i>				<i>Surgical.</i>				Recur- rence	Result not given
	Cured	Im- proved	Unim- proved	Died	Cured	Im- proved	Unim- proved	Died		
Stenosis	0	2	0	4	340	13	8	42	9	18
Adhesions	0	1	0	0	127	4	2	16	5	1
Hour-glass	0	0	2	0	61	3	0	12	3	..
Dilatation	2	0	0	0	7	3	0	1	..	..
Pylorospasm	0	0	0	0	6	0	0	1	..	2

DILATATION—13. (1.7 per cent.)

			Per cent.
Surgical	{ Cured	7	53.0
	{ Improved	3	23.0
	{ Unimproved	0	
	{ Death	1	7.7
Medical	Cured	2	

PYLOROSPASM—7. (0.91 per cent.)

Cured	6	85.7
Death	1	14.3

STENOSIS—504. (65.7 per cent.)

Surgical	{ Cured	340	67.3
	{ Improved	13	2.5
	{ Unimproved	8	1.5
	{ Death	42	8.3
	{ Not given	86	17.0
Medical	{ Improved	2	
	{ Death	4	

ADHESIONS—156. (20.3 per cent.)

			Per cent.
Surgical	{	Cured	127 81.4
		Improved	1 2.5
		Unimproved	2 1.2
		Death	16 10.2
		Not given	1
Medical	{	Recurrent	5 3.2
		Improved	1

HOUR-GLASS—81. (10.5 per cent.)

Surgical	{	Cured	61 75.3
		Improved	3 3.7
		Unimproved	0
		Death	12 14.8
		Recurrence	3 3.7
Medical	{	Unimproved	2

PERIOD UNDER OBSERVATION AFTER CURE. PATIENTS REMAINING WELL.

Time.	Stenosis.		Adhesions.		Hour-glass.		Dilatation.		Pylorospasm.	
	Surg.	Med.	Surg.	Med.	Surg.	Med.	Surg.	Med.	Surg.	Med.
1-6 months	70	2	31	1	12		3	1	2	
6-12 months	59		23		17		3			
1-2 years	69		15		4		1		2	
2-3 years	20		5		4					
3-4 years	13		4		5					
4-5 years	6		1		1					
Over 5 years	9		1		2					
Not stated	106		51		19		3	1		

The sequels, it is well seen, when they produce symptoms that are intolerant or perilous, are surgical affections. The nature of the lesion admits of no other conclusion.

The sequels in unpublished cases number 353. The lesions were not clearly defined or were confused in 53 which are not available for analysis. The greatest number were of 1 to 5 years' duration. All occurred late in life. The summary shows the decade in which the lesions were most frequent.

Adhesions. Largest number (13) between 30 to 40 years. More females than males.

Stenosis. Largest number between 30 to 40 years. More males than females.

Hour-glass. Largest number (4) between 30 to 40 years. All females.

Pylorospasm. Largest number (5) between 20 to 30 years. Seven males; six females.

Dilatation. Largest number of cases, equally divided between 20 to 30 and 30 to 40 years, nine males.

DURATIONS OF SYMPTOMS OF SEQUELS (UNPUBLISHED CASES).

	Adhesions	Stenosis	Dilatation	Pylorospasm	Hour-glass
1-6 months	5	8	18	5	
6-12 months	8	31	15	7	
1-5 years	23	77	31	21	4
5-10 years	10	47	18	3	1
10-15 years	2	4	2	2	1
15-20 years	1	5	2		1
Over 20 years		4			
Not stated	2	2	6	1	1

RESULT OF TREATMENT OF SEQUELS (UNPUBLISHED CASES).

	<i>Medical</i>				<i>Surgical</i>				Recur.	Result not given.
	C	I	U	D	C	I	U	D		
Stenosis . . .	2	4	2	0	131	5	2	18	7S* 7M*	1 Med.
Adhesions . . .	0	1	1	0	40	2	2	6	4S*	1 Med.
Hour-glass . . .	0	0	0	0	6	0	0	1	1	
Dilatation . . .	49	25	0	0	20	2	4	4	1S*	3
Pylorospasm . . .	25	6	1	0	9	4	1	1	1S* 1M*	

* S, surgical treatment; M, medical treatment.

PERIOD OF OBSERVATION AFTER TREATMENT OF CASES THAT WERE CURED,
DURING WHICH TIME NO RECURRENCE.

	Stenosis.		Adhesions.		Hour-glass.		Dilatation.		Pylorospasm.	
	S*	M*	S*	M*	S*	M*	S*	M*	S*	M*
1-6 months . . .	17	2	7	..	1	..	1	16	2	6
6-12 months . . .	11	..	4	..	..	..	3	8	4	4
1-2 years . . .	12	..	4	..	..	..	2	4	..	4
2-3 years . . .	10	1	5	..	..	..	2	13	1	8
3-4 years . . .	5	1	3	..	..	..	..	2	..	..
4-5 years . . .	5	..	2	..	..	..	..	..	1	3
Over 5 years . . .	3	..	0	..	..	..	1	1	..	4
Time not stated . . .	76	2	17	1	5	..	13	19	5	2

* S, surgical treatment; M, medical treatment.

The difference between the cases published and those unpublished is notable in the greater number due to dilatation and to adhesions in the latter. This is due to greater care in giving the cause of stenosis. The surgical treatment of stenosis is attended by a high mortality, but it is presumed the cases were of very grave type and death would have resulted had not interference been permitted. In dilatation the mortality was higher with surgical than with medical treatment. Both forms of treatment were followed by the same percentage of cures. As with the published cases the age and sex were not factors determining the result, apart from their influence in all surgical procedures. It is this class of cases, we must agree with Greenough and Joslin, "which indicates the need of surgical intervention in other than emergency cases of the disease."

FREQUENCY AND MORTALITY OF OPERATIONS. The statistics relating to the various operations present interesting features. The first of the group of tables shows the frequency of gastro-enterostomy and the conclusion therefore, of surgeons, that it is the operation to meet most of the difficulties. The percentage of mortality in gastro-enterostomy is much higher than that of individual operators. Mayo Robson has had a mortality of less than 5 per cent., and later, in ulcer, of 1.7 per cent.; Moynihan (1906) of 3.5 per cent.; Mayo of less than 3 per cent. If a number of operators are grouped, as by Joslin, the mortality is 23.8 per cent., a not wide departure from our statistics.

The mortality in private or unpublished cases, 9.1 per cent., approaches that of single operators. The mortality of excision is high and yet compares favorably with that of gastro-enterostomy, for recurrence took place in 58 of 964 cases of gastro-enterostomy,

or 6.23 per cent., while after excision recurrence took place in 2 of 35 cases, or 5.74 per cent. 2 of the 9 of Mayo Robson's cases relapsed or recurred and 1 was not traced.

The percentage of death, when all the cases of all operators are grouped together, is higher than that of individual operators of large experience. It is well that this is known, for the surgeon who by design operates once or twice only should know the greater mortality. If any blackness can be given to statistics to deter the surgeon who is rushing in to cure dyspepsia, etc., it is also well.

NATURE AND FREQUENCY OF OPERATIONS.

Cases collected from the literature. Total number of operations, 1193.

	Per cent.
Gastro-enterostomy.	96.4 80 80
Pylorotomy	2.4 2.10
Excision	5.1 4 20
Pyloroplasty	6.9 5 20
Cauterization	5 0 41
Dilatation of stricture	4 0 33
Gastrolisis	3.7 2 20
Suture	3.8 2 30

RESULT OF VARIOUS OPERATIONS (CASES COLLECTED FROM THE LITERATURE).

	Gast'ent.	Exc.*	Pyl'ec.	Gas.	Dil.	Caut.	Pylor.	Sut.
C . . .	690	35	21	22	4	3	48	25
I . . .	47	1	1	4	..	..	4	1
U . . .	25	1	..	6	..	..	2	..
D . . .	144	10	2	2	..	2	6	6
R . . .	58	2	..	3	..	..	0	6

* In two cases of excision final result not given.

PERCENTAGE OF CURE OF VARIOUS OPERATIONS.

	Cured or improved. Per cent.	Unimproved or death. Per cent.
Gastro-enterostomy	96.4 76 4	23.6
Excision	5.1 70 6	29 4
Pyloroplasty	6.9 75 3	21 7
Cauterization	5.5 50 0	40 0
Dilatation of stricture	4 100.0	
Gastrolisis	3.7 70 2	29 8
Suture	3.8 68 4	31 6
Pylorotomy	2.4 91 6	8 1

LATE RESULTS OF VARIOUS OPERATIONS (LITERATURE).

Permanency of cure in various operations

	Gastro-enterostomy.	Excision.	Gastrolisis	Pylorotomy.
	c i r d	c i r d	c i r d	c i r d
6 months	126 9 2 144	10 1 30	7 3 6 2	5 1 2
6-12 months	103 8 2	3 ..	5	3
1-2 years	123 7 4	6 ..	3 1	3
2-3 years	36 3 1 ..	2 ..		2
3-4 years	26 3 ..	1 ..	1	
4-5 years	12 1	1 1	1	
Over 5 years	18 2	2		
Time not given	246 11 16 ..	11 .. 2	5	8
Recurrence	58	2	3	

In the remaining operations the data were not sufficient to make any calculations.

CONCLUSIONS. Gastric ulcer is a medical disease. Gastric ulcer with complications and sequels is sometimes a surgical disease; if perforation occurs it becomes a surgical affection at once; if hemorrhage occurs acutely, it is rarely a surgical affection; if repeated and chronic, it is a surgical affection.

If the ulcer is productive of perversion of secretory function alone, it remains a medical affection. Inasmuch as hyperchlorhydria is in part a neurosis, the secretory function can be balanced chiefly by medical, dietetic, and hygienic measures. Even if pyloric spasm attends the hypersecretion and hyperacidity it does not necessarily take the case beyond medical care. It is wrong to submit such patients to operation, unless motor disturbances become prominent.

If the symptoms and physical signs of retention from obstruction, dilatation, hour-glass contraction, or adhesions supervene and persist, the case is surgical.

If the symptoms of gastric ulcer become continuous in spite of medical treatment and incapacity or threaten life, and if hemorrhage recurs and secondary anemia arises, it is a surgical disease. Such cases, however, are always attended by organic sequels.

The extraordinary frequency of chronic gastric ulcer with sequels requiring operation is due to neglect of the treatment of an ulcer in its incipency. Statistics show that most patients are operated on between the thirtieth and fortieth year and have an ulcer history of five or ten years' duration.

What, as a medical attendant, should one do with a case of gastric ulcer? From personal experience and a study of recorded cases I would say, if it is simple uncomplicated ulcer, employ rest, at first absolute and later modified, a suitable diet, and the drugs indicated, for at least four months. If attended by an organic complication, as pyloric obstruction from thickening or from adhesions, or by dilatation, if extreme, or by hour-glass contraction, surgical measures are in order.

If perforation exists there should be no delay in operating.

If hemorrhage exists operation is rarely necessary, and if acute, not unless the peril of hemorrhage outweighs that of operation—a nice estimation of values. If hemorrhage is persistent and gives rise to anemia, operation is indicated. Under any circumstances and until cure is established keep the patient in touch with a surgeon. The physician should never assume the attitude of a distinguished physician who congratulated himself that he did not ask a surgeon suspicion borne out by the autopsy which showed such lesion. It should be the duty of the physician to associate with himself a surgeon, to the end that accidents may be taken care of at once, and organic sequels relieved.

The final very serious duty is the selection of the surgeon. One who has good technical ability and has had considerable experience in gastric surgery should be selected. The operation even of gastro-enterostomy is not trivial and requires the best service at command.

After the surgical procedures of necessity are carried out the patient must be treated medically. Medical treatment must be continued over a period of four months at least; hygienic and dietetic treatment over a period of years.

A patient who has had gastric ulcer should, for all time, observe the hygienic and dietetic rules which keep digestion to an approximately normal state, which prevent anemia, and which, above all, so conserves the nervous system as to prevent neurosis.

THE INDICATIONS FOR, THE METHODS OF, AND THE RESULTS TO BE EXPECTED FROM, THE MEDICAL TREATMENT OF GASTRIC ULCER.¹

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To assemble the evidence that recent experience makes possible in the medical treatment of peptic ulcer and the secondary results of this disease, and to point out what advance has been made, is the first task set us—a part of the subject that will be dealt with by my distinguished colleague, Professor Musser. To decide, in view of all the facts, the most judicious course to pursue, without attempting to press overmuch the importance of any particular method of treatment, is the second task, and to that I devote this paper.

Were we to permit ourselves to take a brief in championing some method with the zeal that success in a comparatively small group of cases sometimes suggests, we should undoubtedly fail in complying with the intention of the makers of this program. Above all things, it appears important at this juncture not to array against each other the comparative advantages of medical and surgical practices. Rather there should be made the deliberate effort so to view the matter that we may concur in deciding upon our place in the treatment of this disease.

We should exclude from consideration those ulcerative processes dependent upon special infections, like syphilis, tuberculosis, and pyemia, except when there can be shown to be a definite relationship between these and peptic ulcer.

¹ An address delivered at the Seventh Triennial Congress of American Physicians and Surgeons, Washington, D. C., May 7, 8, and 9, 1907.

We should attempt to exclude, although perhaps unsuccessfully, certain cases that closely resemble in symptomatology peptic ulcer, but in which, despite the occurrence of pain, tenderness, spasm, vomiting, and hemorrhage, no ulcer actually exists. It is asserted in some quarters that these cases do, in fact, suffer from undiscovered ulcer or fissure through which the bleeding occurs. I deny that this is always true. First, because oozing of blood may be seen through the turgid, deeply congested mucosa that shows no lesion even under the magnifying glass. Second, because we know that mere superficial erosions or fissures in an otherwise healthy stomach are rapidly cured by nature, and, practically, are without symptoms.

Within these limitations there remain two more or less distinct divisions of peptic ulcer. First, the more frequent type, the acute, at least in the beginning, which occurs in younger patients and which appears somewhat more often in chlorotic young women; and, second, the type more commonly developing in older patients, especially men past middle life, often beginning as a chronic ulcer, and hence possessing a greater tendency to persistence. The difference in the history of these two types strongly suggests that their etiology is not identical, and yet, there is enough sameness in the processes to enforce the belief that in most respects they represent a common disease with the presence merely of a variation.

It should be strongly emphasized, if we are to understand the subject aright, that the stomach possesses an inherent and powerful resistance to accidental injury from ordinary causes. It does not readily succumb to infectious foods nor to wounds from foreign bodies.²

I have carefully studied, before and after gastrotomy, the stomach contents of a man who for years swallowed knife-blades, screws, nails, and glass. There was evidently irritation, but, nevertheless, fair digestion of ordinary foods, and, on surgical exploration, while there were scars and areas denuded of mucosa there were no peptic ulcers, nor was there a history of ulcer.³ Beaumont long since proved that the gastric mucosa was repaired with surprising rapidity of injuries deliberately inflicted upon it. There is other evidence that may be adduced to show that the stomach not only resists injury successfully, but that it heals spontaneously in excess of other structures of the body.

From this we must infer that a peptic ulcer includes in its course

² It is interesting to note how the lower animals gorge themselves with putrefied animal tissue, fragments of bone, and irritating substances without apparent injury to the gastric mucosa, although, in the case of dogs, the gastric acidity is extremely high.

³ This was a case of Dr. Gaylord, who made a gastrotomy, and removed 577 foreign bodies of various kinds, besides 141 grains of broken glass, many fragments of which were embedded in the gastric mucosa. Numerous pieces of mucous membrane were separated from the stomach in the efforts to remove the foreign bodies. The patient made a good recovery, and there was little difference in the gastric condition before and after the operation.

and its nature some other factor and quality than a local injury, infection, and an excessively acid gastric juice. We may not exclude these as elements in the cause; they are but steps in a series of which the chief is some influence that removes from the mucosa its inherent resistance—something that, when present, enables it to endure a hyperchlorhydria; when absent, leaves the mucous membrane and the other gastric layers an easy prey to the digesting, eroding, gastric juice.

That this must be true is evidenced in the instances of serious, even fatal, ulcer in patients having gastric juice of low acidity and feeble digestive power, and, conversely, by the numerous examples of hyperchlorhydria with exemption from ulcer.

The preventive treatment, the immediate treatment of necessity and the after-treatment in surgical cases should take cognizance of these important facts. It is because we have not solved this perplexing, but perfectly obvious, problem that we find the embarrassing recurrences both after medical and surgical treatment. For it must be admitted that the knife has not proved to be the panacea in gastric ulcer that it has in appendicitis; and physicians readily consent to the statement that the medical treatment of chronic cases in old men is often unsatisfactory, and in a certain percentage ends in failure.

At least our attitude toward treatment should embrace the acceptance of the reality of a definite lowering of internal cellular resistance in some focus or in foci of the gastric mucosa—points that are more often located near the pylorus, at the lesser curvature, posteriorly.

Weinland believes that in the cells of the gastric mucosa is developed a substance, an antibody, that antagonizes the digesting effect of the ferments. This substance may be absent or much decreased in the focus wherein peptic ulcer develops.⁴ Why this local deficiency? It has been suggested that it follows a nerve lesion, and some have emphasized that it probably depends upon a trophoneurosis. As herpes facialis appears in certain individuals with a slight general infection, after mental or bodily fatigue (and herpes occasionally persists until the general health is restored), or as painful perforating ulcer of the arm or leg, or as a hematoma auris of the insane, may, and apparently do, depend upon a neurotrophic disturbance, so may not the weakness in tissue resistance of the stomach, including the disappearance of antibodies, be likewise accounted for? Granted the actual presence of this local tissue depression, no matter what its nature, we can understand how increased activity, spasm, coarse and irritating foods, external pressure, etc., come to assist in the evolution of gastric ulcer. Eiselsberg, of

⁴ C. Bolton. Trans. Royal Soc., September 28, 1904, describes a specific gastrotoxic serum containing an agent that produces necrosis, and another that produces hemorrhage in the gastric mucosa.

Vienna, advocates and practises the making of a jejunal fistula through which the patient may be abundantly fed. Of course, this establishes gastric rest, but Eiselsberg³ believes that the improvement in the general nutrition of the patient also contributes considerably to the cure as well as to the prevention of recurrence.

Our preventive treatment, then, should be so to guard the patient that the nervous system suffers least strain, that the gastric juice may be moderated in its activity, and that the gastric motility (through improper food, stimulants, etc.) be not exaggerated.

The prevention of gastric ulcer might be summarized thus: maintain a calm nervous system in a well-conditioned body. It has been shown that chlorosis is accompanied by gastric hyperacidity; hence anemia must be overcome. The sharp seeds of fruits, the resisting portions of vegetables rich in cellulose, nuts, salads, condiments, etc., call for unusual, often excessive motor activity of the stomach, and hence should be excluded from the diet.

In acute gastric ulcer the great need is for early diagnosis, for positive conviction, for strict discipline in managing the hygiene, the diet, for relieving the hyperchlorhydria when present, as it usually is, and for prolonged treatment. When this control is righteously observed, there is, as a rule, little trouble in bringing about immediate relief of symptoms and eventually inducing cure of the disease. The unfortunate cases are those wherein diagnosis is uncertain, or the treatment careless, halting, and incomplete. Under such circumstances it is to be expected that a certain percentage will become chronic cases, and a small percentage perforative cases. The fault is not in the possibilities of medical treatment but in its indifferent application. Even in cases in which hematemesis is early and severe this statement holds true.

If in acute hemorrhage the surgeon intervenes and performs a gastro-enterostomy, he is not sure of saving the patient. Indeed, experienced surgeons have informed me that they consider this operation unsuited in acute cases with hemorrhage. It would seem to me an unsafe reliance unless the ulcer area be at the same time attacked. Such an operation would seem to involve a grave risk; far greater than proper medical treatment for stopping bleeding. Nevertheless, in very rare cases in which medical means prove unsuccessful and death is imminent, we should consent to give surgery a trial; but it is somewhat unfair to surgery to expect sure relief in this serious state of affairs.

What medical treatment should be adopted in acute cases with bleeding? Procure the most complete rest obtainable of body and mind and keep the stomach out of function. Sometimes most satisfactory results are obtained by carefully, and very rapidly, washing out the stomach with ice-water,⁴ using a large, soft, blunt-pointed

³ Wiener Klin. Woch., 1906, Nr. 43, p. 1298.

⁴ Ewald, Wien. Klin. Woch., 1906, No. 12.

stomach tube, or by introducing a weak solution of adrenalin. When the bleeding has ceased, wash out the adrenalin solution and pour in a small amount of gelatin solution, quiet the patient with morphine⁷ and atropine or hyoscine; allow him frequently to take bismuth and light magnesium carbonate, suspended in gelatin water, provided there is over-acidity; later introduce (per rectum) frequently small quantities (30 to 60 c.c.) of warm, normal saline solution. Such measures usually control even profuse bleeding.

Thereafter there should be rest without food, except the saline enemas, for several days—a week, perhaps. Should we nourish per rectum? Not at first; for the reason that nutrient enemas excite gastric secretion. After two or three days, or immediately, if needed to prevent collapse, small nutrient injections of milk and glucose should be used. As a rule, the intelligent use of normal saline solution per rectum, small frequent injections, will accomplish more than nutrient enemas, especially early in the case. When hemorrhage persists or threatens, chloride of calcium in doses of 1 to 2 grams, diluted as necessary, may be alternated with the sodium chloride solution.

When should we feed the patient? It is better to enforce absolute rest of the stomach for a period of from three to six days. Should alarming weakness appear, aliment should be given. This should be in the form of a thin gruel of arrowroot, farina, etc., perhaps blended with a little lime water and milk, or, if it appears to agree better, egg albumin in water or expressed beef juice, at first in small quantities (liquid,) unstimulating, and always with close watching of results. If the patient endures the starvation well, let him wait five or six days and then begin feeding small portions of milk or gruel, gradually increased. After a few tentative days, if all goes well, larger amounts should be allowed.

Here arises the question as to which is best,—a scant fare, full fare, nitrogenous or non-nitrogenous foods. A study of the effect of quantity and nature of the food allowable in improving gastric ulcer leads to the conviction that each case must be a law unto itself. One is unwise to insist upon a rule. He should be modest and study his cases carefully. One patient will do best on rather early and rather full feeding, as recommended by Lenhartz; another becomes distinctly worse until complete rest of gastric activity has been carried out for several days, as practised by von Leube. It seems to me that these contradictions are to be explained by the element of gastric and pyloric spasm that plays such an important role in this disease. Hence the question of excitability, of central and local irritability, needs most thoughtful study. Spasm must be prevented, and thereby motor insufficiency relieved, so that free drainage may be effected. If the results are compatible with feed-

⁷ Morphine has the effect of increasing gastric secretion, and hence should be combined with atropine.

ing, the patient should be fed; if made worse by feeding, he should be starved. I am convinced that in suitable cases one need not fear allowing a rather full amount of carefully divided and broken-up animal food (such as meat juice, ground meat, raw eggs, milk preparations, etc.), beginning with small amounts and gradually increasing the quantity, avoiding the factor of stimulation and overcoming any symptoms of hyperacidity by administering, as required, a mixture of cerium oxalate (1 part), bismuth subcarbonate (2 parts), and light magnesium carbonate (4 parts), or lime-water, milk of magnesia, and permitting the drinking of warm alkaline water. On the other hand, when there is marked motor excitability, with a tendency to pyloric spasm that seems to be increased even by bland liquid foods, complete abstinence must be observed for several days. Meantime the external application of poultices, or of cold fomentations, as advised by von Leube, are distinctly useful. The good effect of these external applications may be explained in the soothing action which they exercise upon the motor excitability of the stomach. Provided the organ can be kept in a state of relatively passive relaxation, the stomach will empty itself, and drainage will be secured.

This state of gastric calm is occasionally assisted by the giving of fresh olive oil or unsalted butter. Orthoform or anesthesine are not only useful in diagnosis, as pointed out by Murdock, but also in the control of pain and indirectly of spasm.

Let us insist and teach that patients with peptic ulcer should submit to early and long-continued medical treatment, that they are not cured merely because the symptoms have disappeared, and that they be made to return from month to month, or from week to week, for observation, and at times for thorough examination, including the search for occult blood. In this way only; as indicated by Billings, can we be reasonably sure of good results.

From the medical point of view, surgery is called for in ulcer cases to relieve secondary results; that is, to save life when perforation occurs; to secure drainage when stasis of the second degree exists, and when it is not relieved by medical treatment; to stop otherwise uncontrollable bleeding; to overcome stenosis or the results of perigastritis, such as disturbances of the motor function from adhesions; and to relieve continued severe pain.

To this extent, the indications for surgery are for relief of results of gastric ulcer rather than for the cure of the disease itself. For the cure of the disease in obstinate cases the plan followed by Eiselsberg, which has already been referred to, seems reasonable and may yet win for itself general approval. Except when stenosis exists, gastro-enterostomy alone appears not to be positively curative of peptic ulcer, notwithstanding its usefulness in relieving symptoms. Physicians oppose the operation because it is too unphysiological, because it does not spare the important functions of the

pylorus and duodenum, and because patients subsequently suffer from digestive symptoms, the recurrence of the ulcer, and even the starting of new peptic ulcers in the intestine.

To summarize the medical treatment:

Attempt to secure a calm mind, a quiet nervous system, and improvement of the general health.

Make a positive diagnosis, begin treatment early, and carry it out with painstaking attention to details for a long time.

Obtain general rest. In some cases feed the patient sufficiently, but discretely; in others, starve the patient for a period, depending for support upon frequent, small enemas of normal salt solution.

For the control of hemorrhage, in addition to rest, one may succeed by local treatment through the stomach tube, using ice-water, or adrenalin solution, followed by gelatin water.

In irritating hyperacidity, one should use local general sedatives and antacids.

To relieve hypertension and spasm of the stomach, in addition to suitable drugs, use external applications according to von Leube, or the equivalent of these.

Finally, continue treatment long after apparent cure, and study the stools for occult blood; but we should also remember the dictum of Bettmann⁸ that, "it is not alone the question of how long treated, but how well treated." Statistics mean little, because of the uncertainty of method and the faulty detail so often observed in the treatment of this disease.

STUDIES ON ARTERIOSCLEROSIS, WITH SPECIAL REFERENCE TO THE RADIAL ARTERY.

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AMONG the first things which we record in the every-day examination of a patient is the palpability and consistency of the radial artery. While there has been much discussion as to what inferences one is justified in drawing with regard to the condition of the general arterial tree or of special central vessels, from the condition of the radial, we have, as a rule, little conception as to just what we are feeling in the radial artery itself.

In order to gain information upon this point one of us (Fabyan)

⁸ New York Med. Jour., March 9, 1907.

over a year ago, undertook the study of the radial arteries from a series of consecutive cases which had been previously observed, clinically,

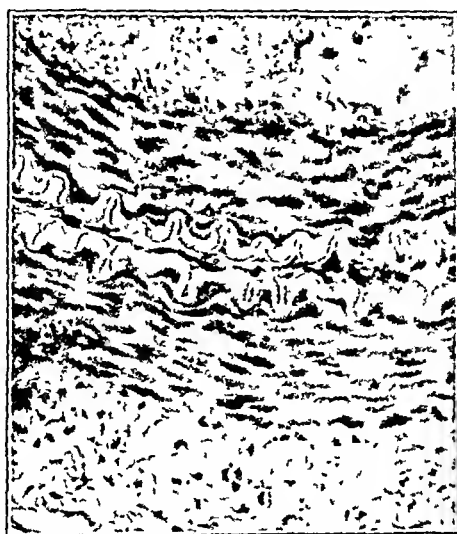


FIG. 1.—Radial artery of a seven months' child (Case 58) who died fifty-six days after birth of bronchopneumonia (hematoxylin and eosin). This artery was not palpable clinically.

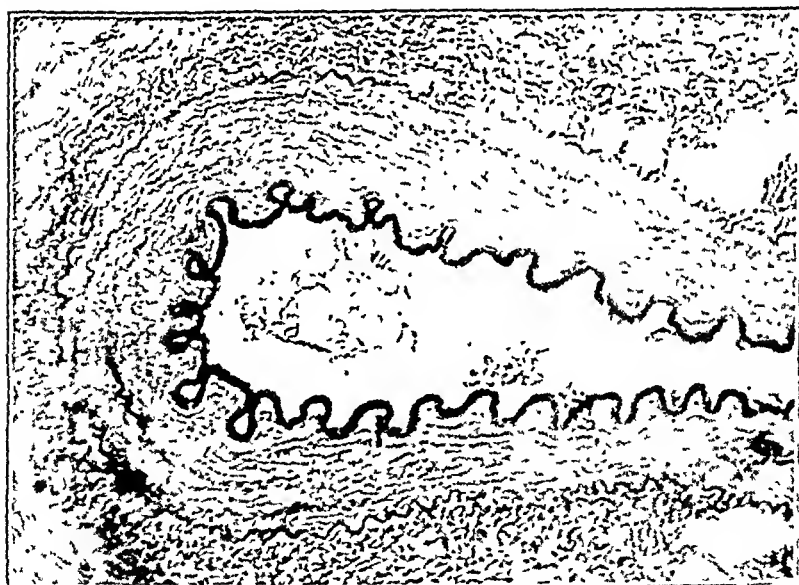


FIG. 2.—Radial artery of a seven months' child (Case 58) who died fifty-six days after birth of bronchopneumonia (Weigert's elastic tissue stain).

in the wards of the hospital. At the same time, for the sake of comparison, there were removed from each case, bits of the aorta

just above the valves and from a point just above the origin of the mesenteric artery, as well as a piece of the mesenteric vessel just below its point of origin.

The first question which we asked ourselves was: *What is the character of the normal radial artery and what are the common changes with which one meets?*

The material consisted of 61 cases, the ages of the patients varying from fifty-six days (in a seven months' child) to eighty-three years. We were immediately impressed with the fact that the radial artery varies greatly in its general characters at different ages.

At birth the artery is delicate, translucent, extremely thin, and collapsible. The surface on opening is perfectly smooth. The intima consists of a single endothelial layer, lying directly on the surface of a deeply undulating elastic interna. The media, which consists of transversely arranged, smooth muscle fibres with rather large vesicular nuclei, has a depth of about seven to eight layers of cells. Connective tissue, if present in the intima and media, is extremely scanty, none being revealed by the Mallory or van Gieson

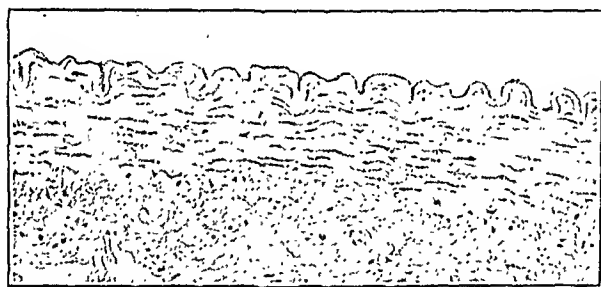


FIG. 3.—Radial artery of a child, aged two and half years (Case 15), who died of general spastic paralysis and bronchopneumonia. This artery was not palpable clinically.

stains. There is, however, a relatively large amount of elastic tissue which appears on cross section as very thin, parallel, slightly wavy lines. The elastic externa is neither as coarse nor as deeply undulating as the interna (Figs. 1, 2, and 3).

The adventitia, considerably thicker than the media, consists of compact connective-tissue fibres with relatively large nuclei. The elastic fibres are fairly numerous, running in various directions.

The picture alters progressively with the age and growth of the individual. The changes are especially striking in the *intima* which, sometimes as early as the middle of the first decade (Figs. 4 and 5), becomes distinctly thickened. This thickening consists in the appearance, uniformly, or at local points in the intima, of a fresh strip of elastica which appears to be lifted up or split off from the surface of the interna. In specimens stained by Weigert's method the elastica interna takes a clear, grey-blue color. With growth and development the inner surface of the interna becomes irregular

and roughened in outline and of a deep black hue. Gradually, the irregular, rough, deeply staining inner layer is at points lifted from the surface of the intima, forming a separate, more or less parallel

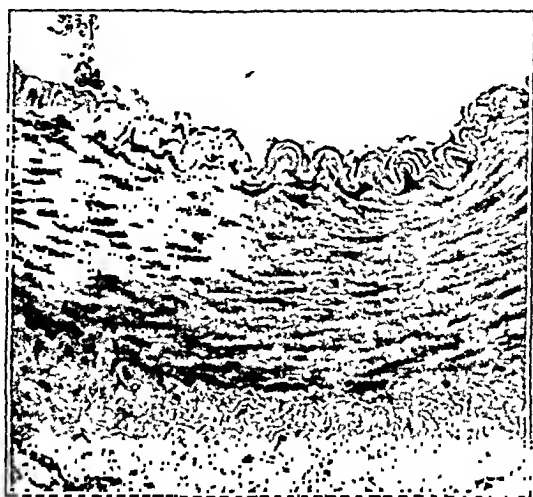


FIG. 4.—Radial artery of a child five years old (Case 61) who died of bronchopneumonia following measles (hematoxylin and eosin). This specimen shows a beginning elastic muscular thickening of the intima with the separation of a second layer of elastica from the surface of the intima. This artery was not palpable clinically.

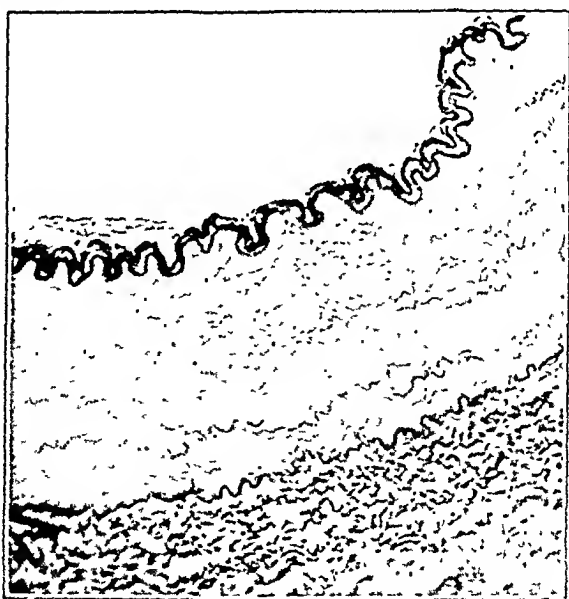


FIG. 5.—Radial artery of a child five years old (Case 61) who died of bronchopneumonia following measles (Weigert's elastic tissue stain). The specimen shows the early separation of an inner layer of elastica from the surfaces of the intima. This inner layer has at points a somewhat beaded appearance.

strand (Fig. 6). This strand on cross section appears beaded, and in longitudinal sections much smoother, justifying, in our opinion, the conclusions of Hallenberger,¹ that it represents a collection of longitudinal fibres. In some specimens, connective-tissue cells may be seen apparently making their way through the interstices of the fenestrated membrane, giving rise to the picture on which Hallenberger bases his hypothesis that ingrowth of connective tissue causes the separation of these inner layers of longitudinal elastic fibres. At the same time between these two layers, and sometimes between the inner layer and the endothelium there appear a few connective-tissue cells and smooth muscle fibres which have in the main a longitudinal course.

The *media* also increases in thickness with the growth of the individual. The elastica in this coat is very scanty in amount, merely an occasional thin wavy fibre. Just external to the elastica interna there may be a delicate layer of connective-tissue fibres.

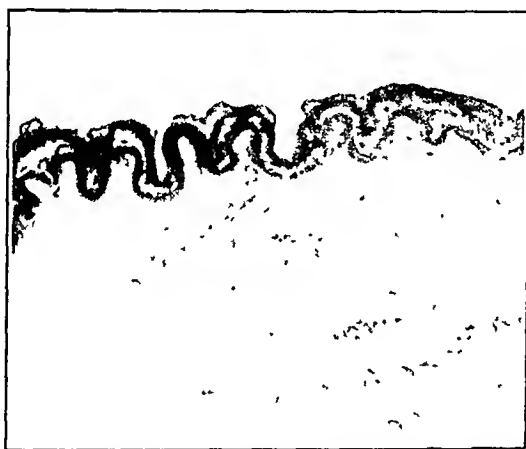


FIG. 6—Radial artery of a child five years old (Case 61) who died of bronchopneumonia following measles (Weigert's elastic tissue stain). The specimen shows the same changes noted in Fig. 5 under a higher power.

In the *second decade* the artery gradually assumes the character of the adult vessel; the walls become thicker but the vessel still lies collapsed like a ribbon on its muscular bed. The surface shows on section a number of delicate, transverse striations, as well as two longitudinal lines which correspond to the points at which the artery folds when in a state of collapse. The cause of the transverse striations is uncertain. Their appearance at the same time with the development of longitudinal elastic and muscular fibres in the intima, and the fact that they disappear when the artery is stretched, have suggested to us that they may be due to the contraction of these fibres.

¹ Ueber die Sklerose der Arteria radialis, Marburg, 1906, 8. This valuable communication did not appear until some time after the beginning of our studies, and was unknown to us until our work was nearly done. It is satisfactory to find that our observations are in most particulars confirmatory of Hallenberger's results.

The *intima* has increased materially in thickness. A second strip of elastica is usually present. More, longitudinally arranged, smooth muscle cells have appeared as well as a small number of connective-tissue cells.

The *media* is also thicker (Fig. 7), the elastic tissue being relatively less marked and not as uniformly dispersed as in the first decade. Delicate fibrils running in various planes seem to arise from the interna and externa. No connective tissue is demonstrable excepting a fine layer just external to the interna.

In one case in this decade, a boy with chronic nephritis, there were local areas in which the intima was slightly more thickened (observable only by the microscope). In these areas, beside the second strand of elastica, there was a meshwork of finer elastic

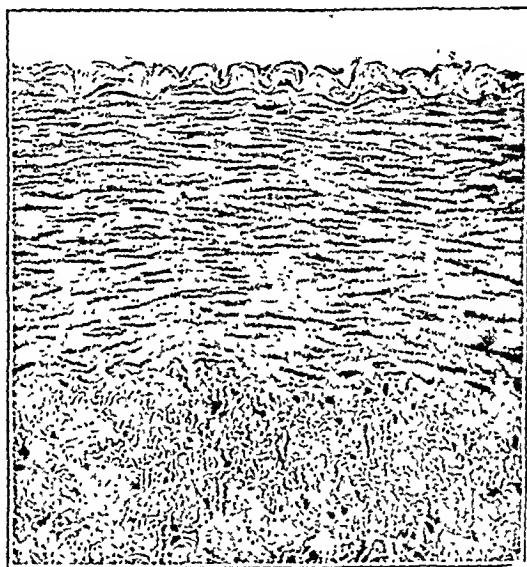


FIG. 7. Radial artery of a girl, aged fourteen years (Case 35), who died of pneumonia and pericarditis (hematoxylin and eosin). The specimen shows early elastic muscular thickening of the intima. This artery was just palpable clinically, but was not regarded as thickened.

fibrils with an appreciable increase in connective tissue. Outside these points the elastica interna seemed less wavy and appeared rather stretched.

In the *third and fourth decades* there is no great change in the constitution of the vessel. The *gross appearance* of the artery when laid open is the same excepting that in a few cases an occasional longitudinal line of irregular length is to be noted. The significance of these is not entirely clear, but their association, as a rule, with the presence of microscopic areas of connective-tissue thickening of the intima which contain numerous fine elastic fibres has suggested to us that they may be due to irregularities in the contraction of the vessel associated with these changes.

The *intima* and *media* tend to become somewhat thicker. The *intima* always shows a second strand of elastica and in several instances as many as two or even three additional strands. In addition to these, sometimes in irregular patches, sometimes more or less uniformly, the larger strands are replaced by a meshwork of fine fibrils with a marked increase in connective tissue (Fig. 8). These areas of connective-tissue thickening are especially noticeable in the vessels of a laborer, aged twenty-two years (No. 37), who had been a very

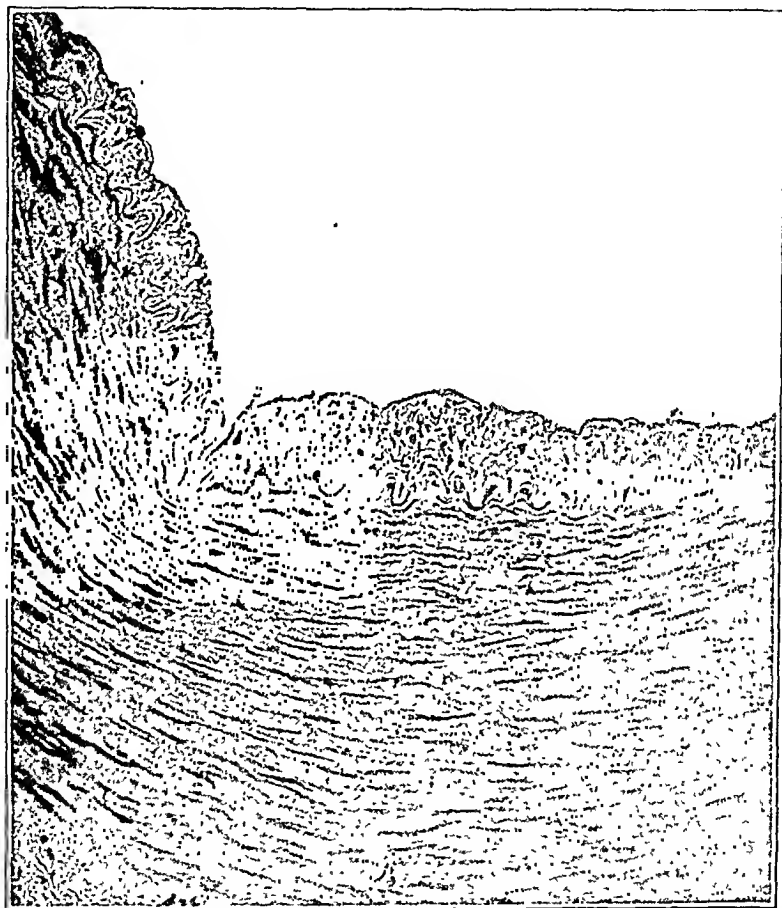


FIG. 8.—Radial artery of a healthy man, aged thirty-two years (Case 38), who died of a traumatic cerebral hemorrhage (hematoxylin and eosin). Elastic muscular thickening of the intima with a local sclerotic patch showing a fine elastic network. This artery was palpable clinically, but was not regarded as a thickened vessel.

heavy worker; of a laborer, aged twenty-five years (No. 60), with chronic nephritis; of a man, aged thirty-one years (No. 48), with aortic insufficiency; of a sailor, aged thirty-five years (No. 33), with mitral and aortic insufficiency and dilated heart. In one of these cases, that of the man, aged twenty-two years, there was a spot of calcification in the deeper part of a marked connective-tissue thickening of the intima (Fig. 9).

The *media* becomes gradually somewhat thicker, and connective

tissue begins to be demonstrable by van Gieson's stain. The connective tissue is always more marked just outside the elastica interna at points of local thickening of the intima.

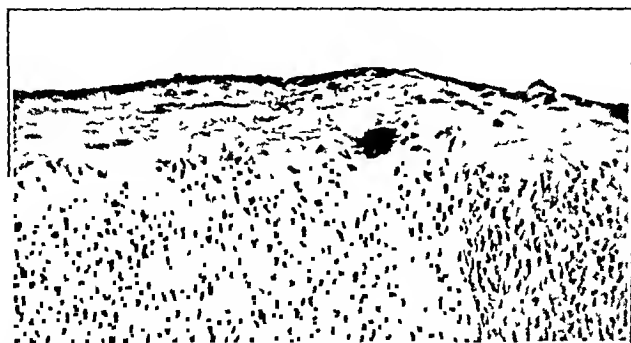


FIG. 9—Aortic artery of a day laborer, aged twenty-two years (Case 37), accustomed to heavy physical exercise, who died of pneumonia. Longitudinal section (hematoxylin and eosin). In the depths of the sclerotic intima is an area of calcification.

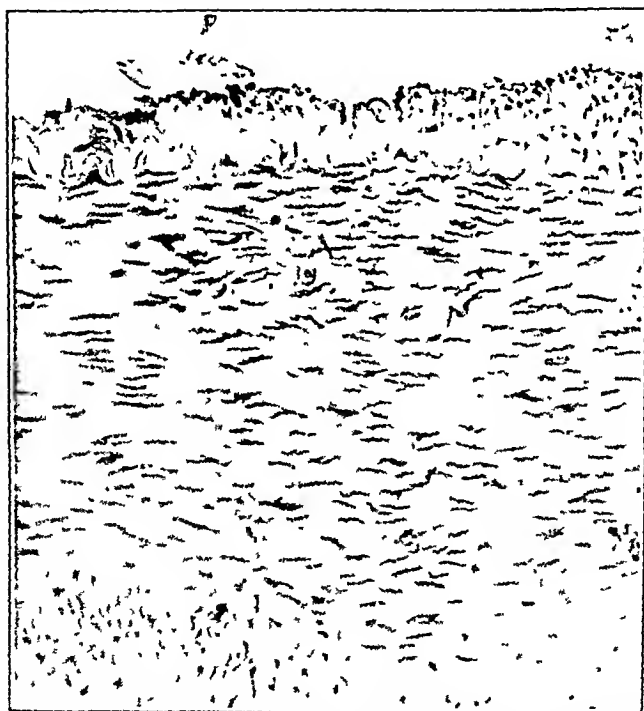


FIG. 10—Radial artery of a day laborer, aged twenty-two years (Case 37), accustomed to heavy physical exercise, who died of pneumonia (hematoxylin and eosin). The specimen shows a local intimal thickening with increase of connective tissue and a fine network of elastic fibers. Marked thickening of the media. This artery was palpable clinically, but was not considered an unduly thickened vessel.

In several instances the media was, on measurement, considerably thicker than the average. Of these cases, 4 in number, 1 was a

day laborer, aged twenty-two years (No. 37), who had been a very heavy worker. This patient also showed a very thick intima with a marked, fine, elastic meshwork and considerable connective tissue (Fig. 10).

The second was a laborer, aged twenty-five years (No. 60), an exceedingly heavy drinker and a heavy worker with chronic nephritis. In this case there was also a considerable thickening of the intima with the separation in some places of two strips of elastica and areas of greater connective-tissue thickening.

One was a man, aged twenty-seven years (No. 42), an exceedingly heavy drinker with an hypertrophied heart. Here the intima, though not very thick, showed the separation of one strip of elastica with small areas of irregular thickening with fine elastic meshwork.

The fourth case was a man, aged thirty-one years (No. 48), with aortic insufficiency; this man had been also a very heavy worker. The intima showed areas of local connective-tissue thickening with a fine, irregular, elastic meshwork. It may be noted that 3 of these 4 cases were also among those selected as examples of especial thickening of the intima.

In the *fifth decade* a decided change occurs. The lumen of the vessel as viewed in gross, remains open and irregularities in the wall may be felt on palpation. In cases which are especially thickened the transverse striations have disappeared and longitudinal lines of varying length are to be noted. In no case are there raised plaques. Plaques are, however, represented by slight cuppings about 3 to 4 mm. in length and about 2 mm. in breadth. Their surface is perfectly smooth; they are usually rather less circumscribed than those observed, for instance, in the coronary artery and of grayer color. Not infrequently these areas show calcification.

The *intima* has become diffusely thickened and begins to contain considerable connective tissue (Figs. 11 to 14). In a number of cases further strands of elastica appear to have separated off from the interna, sometimes as many as three. The areas with connective-tissue thickening and a diffuse fine meshwork of elastic fibres are more numerous. In some of these areas the elastica interna can no longer be distinguished as a separate layer (Fig. 12).

In 6 out of 19 cases in this decade there were areas of calcification in the deep layers of the intima. The tissue about these areas is homogeneous, nearly free from nuclei and takes usually a rather deep, eosin stain. The elastica interna, externally to the calcified spots, is usually stretched and may appear to be broken; it may, apparently, have entirely disappeared.

In 1 case, a man, aged forty years, there was evident bone formation extending from the intima through the destroyed elastica into the media.

The *media* in this decade reaches its maximum average thickness,

but the increase from the last decade is, relatively, considerably less than that of the intima. Opposite the thicker plaques in the intima the media is often considerably thinned, the nuclei elongated



FIG. 11.—Radial artery of a day laborer, aged forty-one years (Case 54), who died of aortic insufficiency and pericarditis (hematoxylin and eosin). Diffuse sclerosis of the intima. This artery was regarded clinically as a thickened vessel.

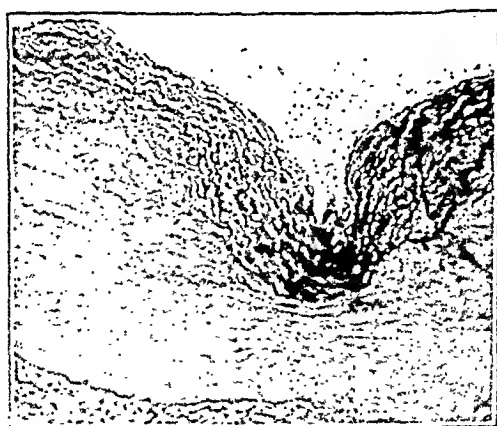


FIG. 12.—Radial artery of a day laborer, aged forty-one years (Case 54), who died of aortic insufficiency and acute pericarditis (Weigert's elastic tissue stain). Diffuse sclerosis of the intima. The elastic interna has disappeared. Meshwork of fine elastic fibres throughout the intima.

narrowed, and diminished in number; there is a good deal of connective tissue. In 3 of those cases in which calcification was noted in the intima there was also a medial calcification, most marked in the inner part of the coat, close to the elastica interna, opposite the points of intimal calcification. In 1 instance it was very extensive, involving nearly the whole width of the coat in

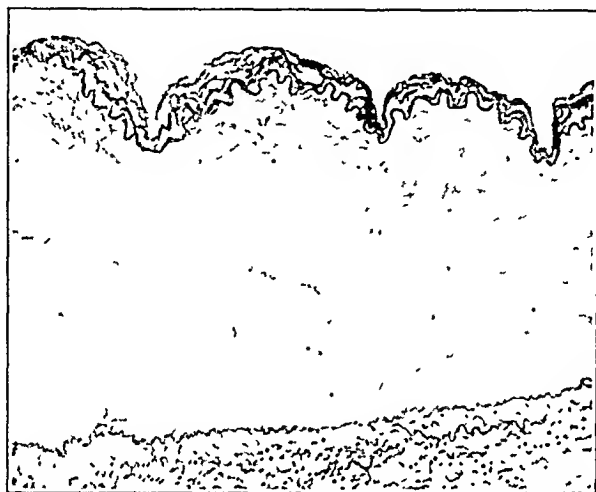


FIG. 13.—Radial artery of a day laborer, aged forty-two years (Case 44), who died of chronic nephritis (Weigert's elastic tissue stain). At points there are multiple strands of elastica. At other points there is a fine elastic network. In places the intima seems thinned and stretched. This artery was regarded clinically as a thickened vessel.

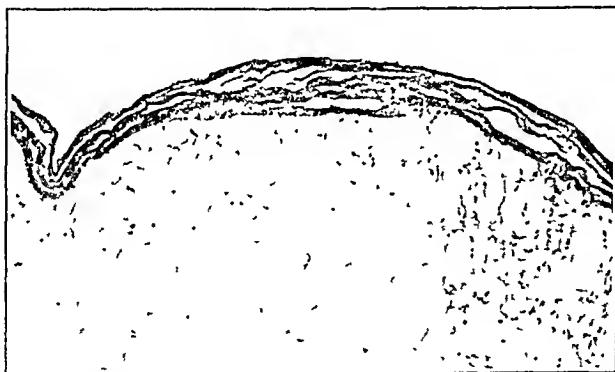


FIG. 14.—Radial artery of a day laborer, aged forty-two years (Case 44), who died of chronic nephritis (Weigert's elastic tissue stain.) Longitudinal section shows multiple strands of elastica in the intima.

places, producing a picture similar to that described by Mönckeberg.² One can sometimes trace the deposition of lime salts directly into muscle cells from which the nuclei have disappeared, while in the periphery of these areas there may be evident hypertrophy of the individual muscle fibers. The tissue about the calci-

² Ueber die reine Mediaverkalkung der Extremitätenarterien und ihr Verhalten zur Arteriosklerose; Arch. f. pathol. Anat. u. Physiol. u. f. klin. Med., 1903, Band clxvi, 141.

fied areas has sometimes a homogeneous appearance staining with eosin, while the nuclei have disappeared.

The elastic tissue in the media is scanty—merely a few thin, straight fibres parallel, in cross sections, to the lumen. In this

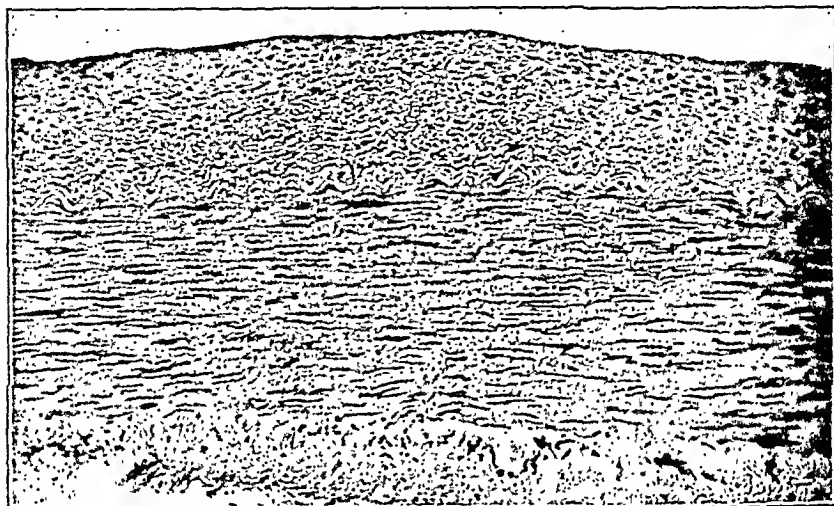


FIG. 15.—Radial artery of a tailor, aged sixty-four years (Case 49), with chronic nephritis and hypertrophied heart, who died of an œsophageal carcinoma (hematoxylin and eosin). Diffuse sclerosis of the intima. Clinically this artery was palpable and regarded as a thickened vessel.

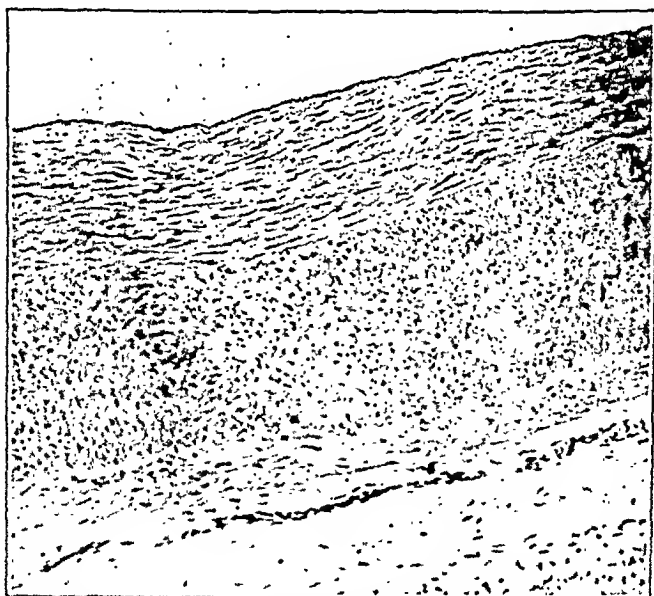


FIG. 16.—Radial artery of a tailor, aged sixty-four years (Case 49), with chronic nephritis and hypertrophied heart, who died of œsophageal carcinoma. Longitudinal section (hematoxylin and eosin). Diffuse sclerosis of the intima.

decade there were 6 cases in which the media was especially thickened. Of these, 3 were instances of chronic nephritis, 1 of aortic insufficiency, and 2 occurred in individuals who had been extremely heavy workers and alcoholics.

After the fifth decade there is a progressive increase in the thickness of the intima. From one to three, more or less regular elastic strips may be split off from the interna, but with advancing years these are less marked and a diffuse connective-tissue thickening of the intima with fine, irregular, elastic fibres becomes the common type (Figs. 15 and 16). Calcification in the deep layers of the intima (Fig. 17) becomes commoner with age, 4 out of 5 cases in the eighth and ninth decade showing this change.

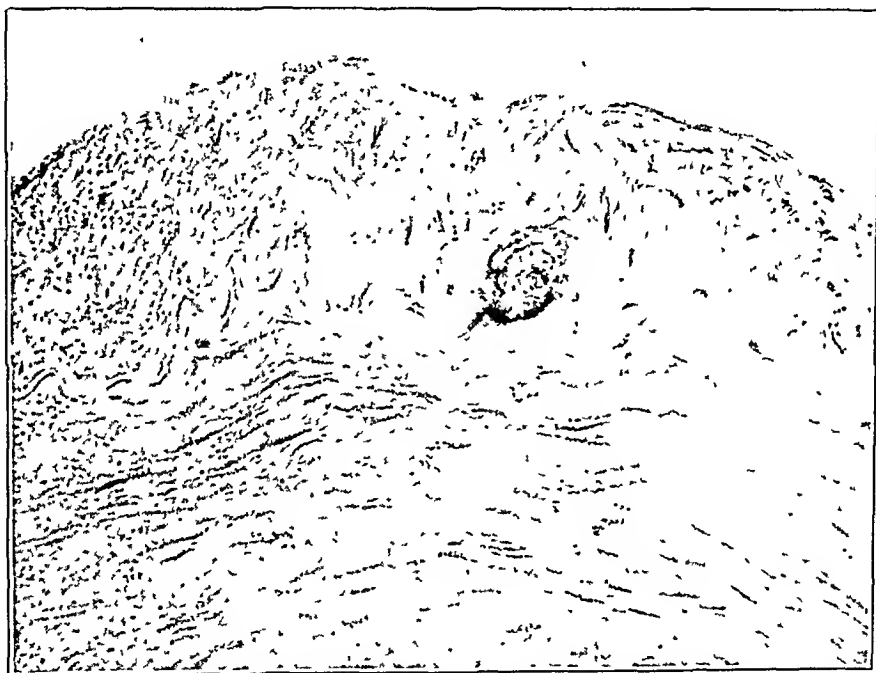


FIG. 17.—Radial artery of a carpenter aged sixty-six years (Case 50), with carcinoma of the stomach, who died of acute peritonitis; high power (hematoxylin and eosin). Calcified area in a sclerotic intima. This artery was clinically a thickened, beaded vessel.

The *media* after the fifth decade becomes, on the whole, rather thinner; there is a marked increase in the connective tissue and the tendency to calcification is greater. Opposite points of especial intimal thickening the media may be much thinned and evidently stretched, while the muscle fibres have in great part disappeared, having given way to connective tissue. The elastica interna in such cases is either much stretched or absent (Fig. 18). In some instances, as shown in the photograph of the artery of a man, aged eighty-three years, the whole vessel may be changed into an irregular, nodular tube (Fig. 19).

It thus becomes clear as pointed out by Jores³ from a general standpoint, and by Aschoff,⁴ and Hallenberger,⁵ with regard to the



FIG. 18.—Radial artery of a blacksmith, aged seventy years (Case 52), a syphilitic, with chronic fibrous myocarditis, chronic mitral and tricuspid endocarditis and hypertrophy and dilatation of the heart, who died of pneumonia (hematoxylin and eosin). Extensive sclerotic plaque of intima with calcification. Widespread sclerosis of media which opposite the plaque is much thinned and stretched. Clinically this was a thickened vessel.

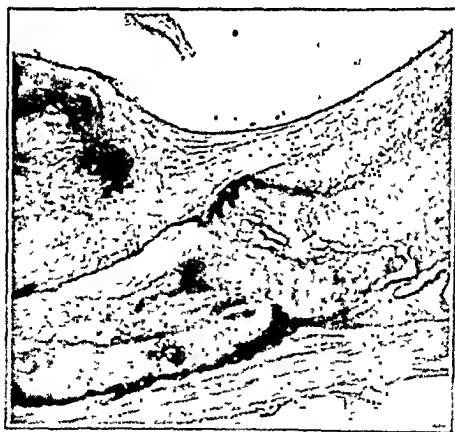


FIG. 19.—Radial artery of a farmer, aged eighty-three years (Case 1), with chronic nephritis and hypertrophied heart, who died of bronchopneumonia (hematoxylin and eosin). Extensive calcification of the intima and media. Clinically this vessel was hard and nodular.

radial especially, that an elastic muscular thickening of the intima appears in the radial artery at a relatively early age, that is, within

³ Wesen und Entwicklung der Arteriosklerose, Wiesbaden, 1903, 8.

⁴ Naturgeschichte der Gesellschaft zur Beförderung der gesammten Naturwissenschaften zu Vöding, Preß, Nr. 8, 117.

⁵ Op. cit.

the first decade. With growth and the associated increase in pressure the artery strengthens itself—in the *intima* by the separation of one or more fresh strands of elastica from the inner surface of the fenestrated membrane, and the appearance about these of a few connective-tissue cells and longitudinal muscle fibres; in the *media* and *adventitia* by a gradual hypertrophy and hyperplasia. After full growth has been reached, at the end of the second decade, there is little change in the thickness of the adventitia. The intima, however, tends to become slightly thicker from the development of more elastic tissue and smooth muscle fibres, while the depth of the muscular media shows a slight increase. Gradually, however, during the third and fourth decades, especially in individuals subjected to heavy physical strain, there appear areas in the intima in which there is a distinct, connective-tissue thickening; the regular elastic strands which are separated from the interna are replaced by numerous, finer, more irregular fibrils, while on the outer side of the elastica, a delicate layer of connective tissue also appears. Opposite these areas the elastica interna is less deeply undulating and seems somewhat stretched, while connective tissue begins to appear between the muscle fibres of the media. *In other words, the strain has begun to tell upon the vessel wall, and the yielding tube fortifies itself by the connective-tissue thickening of the intima and to a lesser extent of the media.* As Aschoff has well expressed it, the artery of the child and that of the young adult with its increased amount of elastic tissue has a low, elastic resistance but a high limit of elasticity. Gradually, with the wear and tear of age or as the result of unusual and excessive strain, the elastic resistance becomes unequal to the burden imposed upon it and the limit of elasticity tends to be passed. The giving vessel then strengthens itself with a substance which has a much higher elastic resistance, but a lower limit of elasticity, namely, connective tissue.

But these changes are not marked until the fifth decade when the artery begins to assume an essentially different appearance. The vessel wall, unable to stand the strain, tends to stretch, and an additional support is offered by the development of firm, connective tissue in the intima, together with an increase in that upon the medial side of the interna and, in lesser degree, throughout the media. The vessel is here usually felt as a firm tube.

Finally, in these sclerotic vessels, degenerative changes set in, which are somewhat different from those seen in the larger arteries, consisting as they do, of local areas of coagulation necrosis with calcification, especially marked in the deep layers of the connective tissue thickenings of the intima and in the muscle fibres of the media, particularly opposite these points. These changes may, as has been pointed out by Mönekeberg, go on to actual bone formation. Although, in one instance, there was an apparent atheromatous

softening in the sclerotic intima of a man, aged seventy years, in not one of our cases did we see the superficial proliferation so common with fatty changes in the aorta.

When these facts are considered it becomes evident that it may often be difficult to draw a sharp line between the normal and the pathological radial artery. That which is normal at 50, would be pathological at 30 years. A connective-tissue thickening of the intima is not to be regarded as pathological in old age.

Regressive changes, necrosis, calcification, and atheroma which, as Jores has pointed out, occur especially, if not only, in a sclerotic intima, must be regarded as pathological.

It is a striking fact that in not one of our cases did we see calcification of the media unaccompanied by similar changes in the intima.

Is the normal radial artery ever palpable? To this question there can, of course, be but one answer. In the great majority of these cases, after the age of twenty years, the radial artery was palpable. Recognizing the fact, however, that if one rolls the artery carefully against the bone the normal vessel is often palpable, we divided our cases, clinically, into those which were not palpable or palpable and not regarded as thickened, and in which the vessel appeared to be distinctly thickened. When we compared our clinical notes with our pathological observations the result was extremely interesting. In the first and second decades none of the arteries were considered as thickened; in the third and fourth decades 77 per cent. were regarded as essentially normal, but in the fifth decade, at exactly that period when the connective-tissue thickening of the intima becomes especially marked, it appears that 63 per cent. of the arteries were regarded, clinically, as thickened vessels.

The arteries which were regarded clinically as thickened showed, in the majority of cases, anatomical thickening of the intima.

The beaded, goose-necked artery corresponded in practically every case to calcification of the intima or of intima and media.

It was our impression that the great frequency of the palpability of the arteries might be due in part to the fact that the majority of our patients were colored. But an analysis of our tables seems to show that, while the frequency of palpable arteries is indisputably somewhat greater among the colored, the difference is by no means as marked as we had fancied that it would be. The observations of one of us (Thayer) show clearly that the percentage of palpability of the radials in this group of hospital patients was much higher than that in healthy individuals in higher walks of life.

A study of the individual cases shows that, as a rule, the thickened vessel becomes evident to the palpating hand. There are, of course,

striking individual exceptions, especially in very fat people. The palpability of the vessel depends apparently on the general thickening of the coats, especially, however, upon the changes in the intima which are progressive throughout life. In cases of aortic insufficiency and in chronic nephritis in which measurements show a considerable thickening of the media as well, this doubtless plays a part in the palpability of the vessel, but according to our measurements and tables the part is subordinate. It is a striking fact, moreover, that the thickening of the intima and the media go usually hand in hand. An analysis of our tables shows that in those cases in which heart hypertrophy was found, the media and intima were almost uniformly thicker than the average, and selecting from these cases those in which aortic insufficiency or chronic nephritis was present, the thickening of both coats appeared, on the whole, yet, more marked, but *it was rather striking that the change was more noticeable on the whole in the intima than in the media*. The same observations are true of those cases in which especially high pressure was noted *intra vitam*.

Comparison of the changes in the radial with those in the mesenteric artery and aorta.

The structure of the *mesenteric artery* is in some ways different from that of the radial.

In gross, the appearances are much the same but on a larger scale. The same transverse striations are visible in the opened vessel of the young adult, and the irregular, longitudinal lines are present in the more thickened artery. The *elastica interna* is a much thicker band. The *media* contains much more elastic tissue which is arranged as a well-marked meshwork. In areas throughout the muscular coat there are conspicuous aggregations of these fibres. The *adventitia* is very much thicker and contains more elastic tissue than that in the radial artery; this tends to have a longitudinal course. (Figs. 19 and 20).

The changes in the intima and media are in the main identical with those in the radial. The same elastic, muscular intima develops early in life and the same connective-tissue thickening in the later decades. Here, also, the change from elastic muscular to connective-tissue thickening begins to be specially noticeable in the fifth decade.

Two points, however, are striking in the mesenteric arteries which have been examined, namely: (1) Calcification is apparently much less frequent than in the radials. (2) In several cases plaques were seen with fatty softening of the deeper layers of the intima and superficial proliferation—a picture which we have never seen in the radial.

In the *aorta*, as pointed out by Jores, the elastic-muscular intima

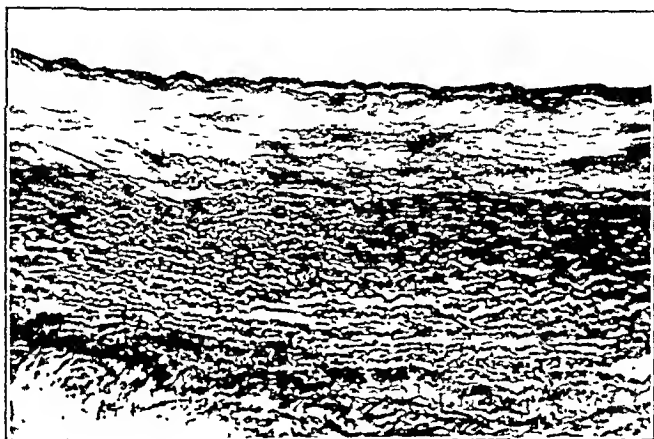


FIG. 20.—Mesenteric artery of a child, aged five years (Case 61), who died of bronchopneumonia following measles (Weigert's elastic tissue stain). The specimen shows the different arrangement of the elastic tissue from that seen in the radial artery. A second strand of elastic tissue has been separated from the surface of the intima.

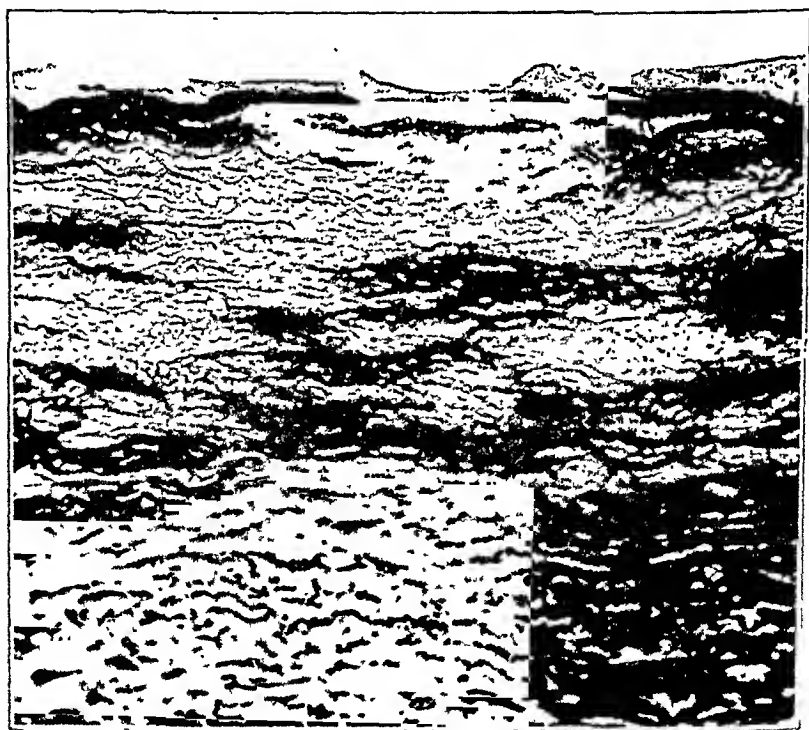


FIG. 21.—Radial artery of a child, aged five years (Case 61), who died of bronchopneumonia following measles (Weigert's elastic tissue stain). Shows the same condition as Fig. 20, but at higher power.

thickens progressively with age. This is beautifully borne out by Fabyan's measurements. Indeed, our tables, showing the thickness of the intima of the radial and the mesenteric arteries and the aorta, side by side, show a striking, progressive increase in the depth of the intima from birth to old age in all vessels, with the onset of connective-tissue sclerosis especially notable in the fifth decade. The disposition of the elastica in the aortic intima is much less regular than in the other vessels. The regressive changes, commoner in the thicker intimas, are particularly prone to be in the form of necrosis with fatty change and softening (atheroma) associated with active proliferation of the intima on the surface of the plaque.

In the aorta and mesenteric artery likewise over-strain and high pressure appear to result in changes analogous and more or less parallel to those in the radials. There are exceptions in individual cases which are sometimes striking. But, on the whole, when one finds an undue thickening of the intima in the radial, analogous changes are usually found in the mesenteric artery and aorta.

What inferences, then, are we justified in drawing from the presence of a thickened radial artery?

In old age a thickened radial artery represents conditions which are normal and to be expected, not only in peripheral, but in central vessels.

An unduly thickened radial at an earlier age may mean one of two things:

1. The vessel has been subjected to unusual and exceptional strain, or
2. It is a vessel which, from inherent weakness or other individual circumstances, has been unable to cope with conditions which might ordinarily be regarded as normal.

In either case the result has been the same; the artery has been obliged to fortify itself by progressive thickening of its walls, especially by a connective-tissue sclerosis of the intima and media.

As a rule, although there are striking individual exceptions, when the thickening of a radial artery is *unduly* marked, similar changes occur in the intima of the mesenteric artery and aorta. The early sclerosis of the intima, associated as it commonly is with like alterations in the muscular coat, constitutes a predisposition to those regressive changes (calcification, atheroma) which may be dangerous in other parts of the body. The distribution of such changes is irregular and too often not to be determined *intra vitam*, but the unduly palpable radial artery indicates a strong possibility of their existence in some part of the body at least, and may thus reasonably be regarded as a signal of danger.

THE SIGNIFICANCE OF TUBERCLE BACILLI IN THE FECES.

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THE detection of tubercle bacilli in solid or well-formed stools of several patients whose histories were vague and in whom the clinical diagnosis was far from clear, led me to take up this subject for research. The idea was actually to see how prevalent is the occurrence of acid-fast bacilli in the feces, by studying the feces of others than those suffering from known tuberculous infection. With this end in view during the last two years, 612 cases were collected from the wards of the Philadelphia General Hospital. Together with this number there were stools of 60 cases of diagnosed tuberculous infection, making in all 672. The stools were obtained from patients with croupous pneumonia, typhoid fever, erysipelas, diarrhoea, surgical and nervous disorders, and from individuals who were apparently healthy; in fact, from patients in all wards of the institution, no matter what the clinical diagnosis. Of these stools 137 were solid, 297 were semisolid, and 178 were fluid. The tubercle bacillus was found in 120 cases, or 19.6 per cent.; in solid stools 28 times; in semisolid stools 40 times, and in fluid stools 52 times. In the 60 cases of diagnosed tuberculosis, the organism was demonstrable in all, no matter what the consistency of the feces.

It has been observed by some writers that acid-fast bacilli have been found in the feces of those suffering from enteric fever, and that it is quite common for them to be found in all specimens of feces even in health; that this latter assertion is absolutely erroneous will be shown by the results of the studies here recorded. The presence of the tubercle bacillus in the feces may be a process of excretion; wherefore a few experimental studies regarding the excretion of bacteria in general may be quoted.

Newmann¹ and Karlinski² observed *Bacillus typhosus* in the urine in 35 out of 112 cases examined. Wyssokowitseh³ in 22 experiments employed fourteen bacterial species; only twice were the species introduced into the blood, and yet they were found in the content of the intestine. On each occasion there were macroscopic hemorrhages into the serosa and mucosa. He concludes that the passage of bacteria into the excreta occurs only when the blood containing them escapes through some breach of continuity in the excretory membrane due to inflammatory or mechanical injury. Dobroklouski⁴ in Cornil's laboratory found that the bacillus of

avian tuberculosis, when administered with food, infected guinea-pigs by penetrating the healthy intestinal mucosa.

As corroborative evidence, numerous investigators have performed experiments by feeding, by subcutaneous and intravenous inoculations, and proved that the organisms pierce and reach the mucous membrane without any evident lesion being present.

Emmerich and Buchner,⁵ after injecting *Bacillus neapolitanus* into the blood, found that the organism escaped in large numbers through the intestinal wall. In one experiment no pathological change in the intestinal wall was observed, but in almost all there was blood in the contents of the intestine and hemorrhages in the mucosa. Sherrington,⁶ in concluding his article on the escape of bacteria with the secretions, says the evidence is against believing that when the transit of bacteria across the secreting membrane occurs the membrane is still normal in condition, although at the same time it may not be ruptured or pervious to red blood cells.

The fact that the escape of the bacteria tends to occur not immediately upon the introduction of them wholesale into the circulation, but in the late stages of the communicated disease, suggests that the healthy secreting membranes are not pervious to bacteria, and that only after soluble poisons produced by the infection have had time to act upon them do the membranes become pervious to the germs.

Babes⁷ concludes, from experimental work upon glanders, that the bacillus can penetrate uninjured mucous membranes. At this point may be mentioned the well-known experiments of Ravenel, who, shortly after having fed animals tubercle bacilli, killed them and found the bacilli in the thoracic duct, though no lesions or abrasions of the mucous membrane of the gut were evident.

As another instance of the penetration of mucous membranes by pathogenic organisms, typhoid bacilluria may be mentioned. This condition was studied at some length by Koujojeff,⁸ by Charrin and Ruffer, Ruffer, Schweiger, Blachstein, Corrado, Pernice and Scagliosi, Cornil, and others, quoted by Sherrington.⁹ They have proved, by experiments upon animals with various bacteria, that it is quite common for bacteria to be found in the bile or urine after intravenous or subcutaneous inoculation or even after feeding alone.

Griffith¹⁰ has shown that when tubercle bacilli are injected into a cow the milk may be infective without disease of the udder.

I inoculated rabbits and guinea-pigs subcutaneously with a homogenized culture of attenuated human tubercle bacilli. Upon the fourth day I detected tubercle bacilli in their feces. After seven weeks the animals were killed. The guinea-pig showed neither a local nor visceral lesion, not even intestinal lesions, while the rabbit,

⁵ Arch. Hyg., vol. xi, p. 357.

⁶ Jour. Path. and Bact., 1893, p. 276.

⁷ Comptes-rend. Paris, 1888.

⁸ Central. f. Bact. u. Parasit., 1889, vol. vi, p. 672. ⁹ Loc. cit.

¹⁰ Royal Commission on Tuberculosis, Brit. Med. Jour., 1907, ii, 211.

though no visceral lesions were found, had a caseous mass at the site of inoculation and in the right inguinal region. A second series of guinea-pigs and rabbits was inoculated in the same manner and with the same organism. I again found tubercle bacilli in their feces at the end of the fourth day. These animals were killed at the end of the sixth week and at autopsy no intestinal, visceral, or glandular lesions were present in the guinea-pig, but the rabbit showed a large, apparently caseous mass in the right inguinal region in which I was unable to find tubercle bacilli.

Examination of a number of specimens of feces from guinea-pigs and rabbits in apparent health failed to reveal any acid-fast bacilli. In well-defined instances of pulmonary tuberculosis it is the rule to find tubercle bacilli in the feces. If a case comes under the observation of the clinician which is not at all clear, but presents a clinical picture resembling malaria, enteric fever, or acute miliary tuberculosis, the finding of tubercle bacilli in the feces will determine the diagnosis. In those suffering from chronic diarrhoea, with no other appreciable symptoms, pulmonary or otherwise, the tubercle bacillus is at fault in most cases. These cases have frequently come to autopsy, some showing intestinal ulceration and others showing no ulceration.

Instances of ascites, the exact nature of which was unknown, were diagnosticated positively as tuberculous by the finding of the tubercle bacillus in the feces. These cases were further proved by surgical procedures, that is, abdominal operation. As a well-marked intestinal tuberculous ulcer is appreciable from the appearance of the serous coat of the gut, in one case thus operated upon, no ulcers were present.

That tubercle bacilli are in the feces, irrespective of a pulmonary or an intestinal lesion is proved by the fact that I found them in cases of general glandular involvement, meningitis, hip-joint disease, and Pott's disease of the spine, the latter condition being in a boy aged five years.

In acute miliary tuberculosis, diagnosticated or not clinically, the bacillus was present in the feces in all cases. The result of these studies suggests the intestinal mode of infection in tuberculosis in general. It is my intention merely to quote a few observations supporting the theory of the intestinal infection in tuberculosis, as these studies strengthen that theory. This theory of infection is gaining ground daily and the experiments of Schroeder and Cotton,¹¹ of Ravenel, and of Vallee who practically confirmed Ravenel's feeding experiments by working upon calves, of von Behring, and Calmette, and Guerin's work upon goats, demonstrate fully that the intestine is by far the most common path of infection and that aërial infection is uncommon.

¹¹ Bull. No. 86, Bureau of Animal Industry of Department of Agriculture.

In a number of autopsies in which the mesenteric and other glands were studied bacteriologically, it was found that over 40 per cent. showing no tuberculous lesions in any part of the body were tuberculously infective. It was also found that in all cases of active tuberculosis and in almost all cases of inactive tuberculosis, the mesenteric glands were tuberculously infective.¹² Supporting von Behring's theory that the most frequent method is through the intestinal wall, Guthrie found over 22 per cent. of infections through the intestinal tract, Heller nearly 40 per cent. of primary intestinal affections, and Still over 23 per cent.

To explain the presence of the tubercle bacillus in the feces of man is not easy. I believe that the bacillus enters the human economy through ingestion (water?), either in infancy or maturity. At first the number of bacilli is not large, and they find their way to the blood and lymph stream. During their transit some are discharged through the feces and others through the urine. The circulation of these organisms through the lymph and blood continues indefinitely, and the patient actually suffers from a toxemia which may be so severe as to set up chronic diarrhoea, or cause vague symptoms characteristic of no one disease.

As the organisms multiply in the body and as the toxemia and irritation progress, a point of least resistance is somewhere established; the tubercle bacillus lodges and sets up the disease, with its distinct pathological features. It is interesting to note that in cases of healing tuberculosis, or actually arrested or healed cases, the tubercle bacillus is rarely if ever found in the feces. This is also true of the occurrence of tubercle bacilli in the sputum. In some of these cases recorded, the sputum has been examined at least six and as many as twelve times negatively, and subsequent examination of the feces was also negative.

Passler,¹³ in considering the diagnosis of pyretic conditions, as septicemia and typhoid fever, mentions the probability of acute intestinal tuberculosis being the cause of the malady, irrespective of tuberculosis of any other organ. During the evolution of intestinal tuberculosis, he suggests that the infection by pyogenic organisms will perform the same role as they do in ulcerative pulmonary tuberculosis, and asserts that when we are dealing with a marked pyretic condition, which has lasted for several weeks without any particular and definite signs to indicate typhoid fever or septicemia, we must always think of an acute intestinal tuberculosis. He concludes by saying that as an intestinal infection may occur without any manifestations clinically the feces should be examined for the presence of tubercle bacilli. He cites only 2 cases.

Wood¹⁴ states that tubercle bacilli are found in the feces of persons

¹² Rosenberger, A Study of the Mesenteric Glands in their Relations to Tuberculosis, AMER. JOUR. MED. SCIENCES, July, 1905.

¹³ Münch med. Woch., October 23, 1906.

¹⁴ Chemical and Microscopical Diagnosis, 1905.

suffering from tuberculosis (pulmonary), because in the majority of cases the bacilli are swallowed together with small masses of sputum. Sahli¹⁵ mentions that in intestinal tuberculosis tubercle bacilli are found in the feces and are therefore of diagnostic importance. "The stools may, however, contain these bacilli even though there is no intestinal tuberculosis (if the patients swallow their sputum). Searching the stools has even been recommended for the diagnosis of lung tuberculosis in cases of irresponsible persons who swallow the sputum. Previous treatment with dilute potassium hydroxide or digestive enzymes is often successful and may be serviceable in the examination of mucopurulent particles of the movement which have been isolated from the mass of feces. We do not know whether, under certain conditions, decomposition will destroy tubercle bacilli in the intestine. At any rate, we cannot always demonstrate tubercle bacilli in the stools, even when there is undoubted intestinal tuberculosis. Perhaps this is on account of the dilution of the content of tubercle bacilli by the abundant particles of food. Tubercle bacilli are most readily found in the purulent or bloody pieces of diarrhoeal stools. As tubercle bacilli in the feces may be due to swallowed sputum, we can diagnose intestinal tuberculosis if bacilli are found in the feces only, when at the same time, attacks of diarrhoea occur with pus and blood in the stool. The tubercle bacillus must be carefully distinguished from the smegma bacillus, which is said to occur at the anal orifice and might have become mixed with the feces."

Lichtheim¹⁶ says that the presence of tubercle bacilli in the stools is the exception rather than the rule in persons suffering from pulmonary tuberculosis. He further asks the question whether the presence of these organisms in the feces means intestinal ulceration or merely that the patient has swallowed them with his sputum. In control observations he showed this not to be the case, as he claimed it was only exceptional to find the bacilli, since they were very difficult to find and then only a very few were present.

In January, 1897, Shaw¹⁷ mentions the finding of tubercle bacilli in the feces of a patient exhibiting no tuberculous lesion of the intestinal tract. The lungs, however, showed isolated tubercles and areas of bronchopneumonia.

Emerson,¹⁸ in remarking upon the occurrence of tubercle bacilli in the feces, says that it must always be borne in mind that the organisms may be swallowed, especially in children in whom the diagnosis of pulmonary tuberculosis has been made; "but this is rather a remote possibility in the case of a careful adult."

Boston¹⁹ recommends collecting a "small portion of the purulent

¹⁵ Diagnostic Methods, 1905.

¹⁶ Fortschritte d. Med., January, 1883.

¹⁷ Jour. Amer. Med. Assoc., March 20, 1897, p. 554.

¹⁸ Clinical Diagnosis, 1906, p. 390.

¹⁹ Ibid., 1904, p. 250.

or mucoid material from the feces, smear it thinly on a slide," and then stain as for tubercle bacilli in the sputum. "Tubercle bacilli when found in the feces point conclusively to the existence of tuberculous ulceration of the intestines."

Simon²⁰ claims that when tubercle bacilli are present in the feces, it indicates intestinal ulceration, providing they are observed upon repeated examinations and there are clinical symptoms pointing to the bowels as the seat of the disease; otherwise, they may be referable to swallowed sputum.

Technique. If the feces to be examined was fluid or semisolid, a small quantity from any part of the stool was taken and spread on a slide, dried, and stained. When the feces were solid, a small amount of sterile distilled water was put upon the slide and a small mass of fecal matter added, mixed thoroughly, spread, dried, and stained. Not one of the specimens was centrifugalized.

In staining the preparation, carbol-fuchsin was applied for fifteen minutes in the cold, the excess drained off, and Pappenheim's solution poured on the preparation. This was allowed to act for two or three minutes, washed with water, and if the specimen was of a uniform blue color it was dried and examined in cedar oil. If the preparation was not uniformly blue, Pappenheim's solution was applied and reapplied until the smear was blue. By observing this technique carefully, no mistake can happen regarding the diagnosis of the tubercle bacillus, as this organism and spores of other bacilli are the only bodies retaining the carbol-fuchsin stain. All other bacteria and cellular elements are stained blue. Great care must be taken lest some artefact be mistaken for the tubercle bacillus, such as a minute scratch in the glass, a small crystal, or the periphery of a cell. The organisms, as a rule, are comparatively few, in cases not plainly diagnosed as tuberculous, but in well-marked cases of pulmonary or intestinal tuberculosis they are comparatively abundant. The finding of the tubercle bacillus in a smear is not always easy of accomplishment; it has frequently taken me at least an hour and sometimes as long as two hours to find three or four bacilli.

Direct searching through solid stools is less promising than in fluid stools. Nevertheless, tubercle bacilli may quite frequently be demonstrated in solid movements, if, as Hamberger²¹ recommends, we mix a piece of feces the size of a pea with a few centimeters of water, then centrifuge gently to remove the coarser pieces, dilute the supernatant cloudy fluid with a double volume of alcohol, centrifuge once more, and then after drying examine the remaining precipitate which will consist almost exclusively of bacteria. Personally I have never found this procedure necessary.

Park²² recommends searching in the feces for any purulent or

²⁰ Clinical Diagnosis, fifth edition, 1904, p. 328.

²² Pathogenic Microorganisms, 1905, p. 312.

²¹ Quoted by Sahli.

mucous particles, and if none are found the larger masses are removed, the rest diluted and centrifugalized, and stained by the ordinary methods.

Page²³ mixes a small mass of feces in 1.5 c.c. distilled water, adds 54 c.c. of a mixture of equal parts of alcohol and ether, centrifugalizes ten minutes, makes a smear of the sediment, fixes it to the slide with albumen, and stains as usual.

If the assertion that the tubercle bacilli found in the feces result from swallowing sputum or the presence of intestinal tuberculosis is true, the examination of the feces is useless, as no further knowledge is gained.

It is a well-known fact to students of tuberculosis that a persistent diarrhoea is present for a very long time, and yet the autopsy shows no ulcerations in any part of the intestinal canal. Therefore, it is by no means certain, if we find tubercle bacilli in the feces of those suffering from tuberculous enteritis, that ulcerative lesions are present. But, suppose that acid-fast bacilli are present in the feces of a person not suffering from any appreciable lesion of tuberculosis, what then is the significance of such a finding?

I believe from the studies made of this number of cases, both from a clinical and pathological standpoint, that if an acid-fast bacillus is present in the feces of any individual, and this organism resembles morphologically and tinctorially the tubercle bacillus, tuberculosis of some part of the body exists. I do not mean pulmonary tuberculosis, but tuberculosis of the intestines, liver, lymph nodes, peritoneum, or any viscus.

A *resume* of some of the cases that came to autopsy, with general remarks concerning some of the patients who did not succumb to the disease, is of great interest and very instructive, and is appended. In almost two-thirds of the cases I was fortunate in being able to follow the clinical findings with those at autopsy. A few of the patients were removed from the institution in a precarious condition, and although a number of them died no autopsy was permitted.

CASE I.—Clinical diagnosis, cirrhosis of liver with ascites. There was no expectoration. Three days before death delirium set in, suggesting meningitis. At autopsy military tuberculosis of lungs and tuberculosis of the peritoneum; no intestinal ulcerations.

CASE II.—Clinical diagnosis, chronic pleurisy. Eleven examinations of sputum were negative. At autopsy pleura was one-eighth of an inch in thickness over right lung and the same lung showed military tuberculosis. No intestinal ulcerations.

CASE III.—Clinical diagnosis, acute military tuberculosis. The sputum was examined on nine occasions with negative results. At autopsy military tuberculosis of lungs and spleen. No intestinal ulcerations.

CASE IV.—Clinical diagnosis, acute miliary tuberculosis. At least six examinations were negative for the tubercle bacillus. At autopsy there was found acute miliary tuberculosis of all the viscera; no intestinal ulcerations.

CASE V.—Clinical diagnosis, pleurisy and tuberculosis of hip. Sputum on a number of occasions was negative for the tubercle bacillus. At autopsy there was acute miliary tuberculosis of all viscera; no intestinal ulcerations. (Three weeks after finding the tubercle bacillus in the feces, it was found in the sputum.)

CASE VI.—Clinical diagnosis, typhoid fever. No expectoration, and there were four negative Widal reactions. At autopsy six small, irregular, atypical ulcers; long axis transverse to bowel; one of these ulcers had perforated the gut. Studied bacteriologically, these ulcers showed few tubercle bacilli.

CASE VII.—Clinical diagnosis, tuberculosis of the hip. No autopsy.

CASE VIII.—Clinical diagnosis, acute miliary tuberculosis. Acute miliary tuberculosis of all viscera was found at autopsy, but no intestinal ulcerations.

CASE IX.—Croupous pneumonia and pleurisy. No tubercle bacilli found in the sputum. Crisis occurred, but there is still an irregular temperature.

CASE X.—Clinical diagnosis, chronic diarrhoea. No cough; no expectoration. No autopsy.

CASE XI.—Clinical diagnosis, chronic diarrhoea. After finding tubercle bacilli in the feces, slight impairment of resonance was noted in the right apical region.

CASE XII.—Clinical diagnosis, chronic diarrhoea and cirrhosis of the liver. No expectoration. Tuberculous ulcers were found in the gut at autopsy.

CASE XIII.—Clinical diagnosis, repeated attacks of pleurisy. No expectoration. No autopsy.

CASE XIV.—Clinical diagnosis, pleurisy with effusion. Sputum negative on four occasions for the tubercle bacillus.

CASE XV.—Clinical diagnosis, chronic diarrhoea. No expectoration. Typical tuberculous ulcers of the gut were found at autopsy.

CASE XVI.—Clinical diagnosis, erysipelas and diarrhoea. No expectoration. Slight pulmonary lesions were found; no intestinal ulcers.

CASE XVII.—Clinical diagnosis, septicemia, pelvic abscess, typhoid. Acute miliary tuberculosis of all viscera; no intestinal ulcers.

CASE XVIII.—Clinical diagnosis, malignant endocarditis. No expectoration. Acute miliary tuberculosis of all viscera; no intestinal ulcers.

CASE XIX.—Clinical diagnosis, chronic diarrhoea. At autopsy, intestinal ulcers were found.

CASE XX.—Clinical diagnosis, alcoholism. No expectoration. Recent and old lesions were present in the lungs; no intestinal ulcers.

CASE XXI.—Clinical diagnosis, tuberculous peritonitis. At autopsy tuberculous peritonitis and intestinal ulcers were found.

CASE XXII.—Clinical diagnosis, pleurisy. Tuberculosis of both pleuræ, of mesenteric glands and spleen; no pulmonary or intestinal lesions found.

CASE XXIII.—Clinical diagnosis, chronic diarrhœa. Tuberculous ulcers present.

CASE XXIV.—No clinical diagnosis made. At autopsy general miliary tuberculosis was found, but no intestinal lesions.

CASE XXV.—Clinical diagnosis, enteritis. This case was a child two years old and treated for seven months for gastro-enteritis; there was no cough, no expectoration; the cervical glands were enlarged.

CASE XXVI.—Clinical diagnosis, tuberculous peritonitis. Patient had cavities in both lungs, yet no sputum could be collected.

CASE XXVII.—Clinical diagnosis, Pott's disease. This case was a child five years old; no pulmonary lesions demonstrable. No autopsy.

CASE XXVIII.—Clinical diagnosis, typhoid fever and pneumonia. No tubercle bacilli were demonstrable in the sputum on several different occasions, and during illness two negative Widal tests resulted, and blood showed a leukocytosis of 17,000. At autopsy acute miliary tuberculosis of both lungs, liver, and spleen, with few intestinal ulcers.

CASE XXIX.—Clinical diagnosis not made. At autopsy, general miliary tuberculosis; no intestinal ulcers.

CASE XXX.—Clinical diagnosis, tuberculous peritonitis. This case was operated upon and the diagnosis confirmed.

CASE XXXI.—Clinical diagnosis, probable carcinoma of the stomach. Pernicious vomiting, chronic diarrhœa, marked cachexia, and emaciation were among the cardinal symptoms. No autopsy.

CASE XXXII.—Clinical diagnosis, typhoid fever. Child six years old, running a persistent irregular temperature; no pulmonary symptoms, and three Widal tests were negative.

CASE XXXIII.—Clinical diagnosis, secondary anemia. Besides the tubercle bacillus being found in the feces, the ova of *Tricocephalus dispar* and *Ascaris lumbricoides* were present. The malarial parasite was also seen in the blood. (As this was an immigration case, he was immediately deported.)

CASE XXXIV.—Clinical diagnosis, probable tuberculosis of the liver. Bacilli were found on two occasions in the feces. No autopsy.

CASE XXXV.—Clinical diagnosis, not made. Sputum examination negative on three occasions. Caseous tuberculosis of the bronchial and mediastinal glands; miliary tuberculosis of the kidney, liver, spleen, and intestines was found at autopsy.

CASE XXXVI.—Clinical diagnosis, chronic pleurisy. No tubercle bacilli were found in the sputum. At autopsy adhesive pleurisy on both sides was found, together with a few miliary tubercles in the lung. There was no intestinal ulceration.

CASE XXXVII.—Clinical diagnosis, erysipelas. No tubercle bacilli were demonstrable in the first three examinations of the sputum, though a fourth examination was positive. (Three days after tubercle bacilli were found in the feces, pulmonary hemorrhage took place, and the bacillus was found at this time.)

CASE XXXVIII.—Clinical diagnosis, interrupted recovery from typhoid fever. No autopsy.

CASE XXXIX.—Clinical diagnosis, typhoid fever. Acute miliary tuberculosis of a general character was found at autopsy; no intestinal ulcerations.

CASE XL.—Clinical diagnosis, chronic diarrhoea. Tuberculosis of the intestines and tuberculosis of the mesenteric glands were present at autopsy.

CASE XLI.—Clinical diagnosis, acute miliary tuberculosis. No tubercle bacilli were found in the sputum. At autopsy acute miliary tuberculosis of all the viscera was found, but no intestinal ulcers.

CASE XLII.—Clinical diagnosis, chronic diarrhoea and jaundice. X-rays showed gallstone. Tuberculosis of the retroperitoneal glands was observed at autopsy, but no gallstone.

CASE XLIII.—Clinical diagnosis, pneumonia, no crisis, and running an irregular temperature; no tubercle bacilli could be found in the sputum. Healed tuberculosis of the lungs, with tuberculous ulcers in the gut, were found at autopsy.

CASE XLIV.—Clinical diagnosis, typhoid fever. No expectoration. At autopsy acute miliary tuberculosis of a general character was found.

CASE XLV.—Clinical diagnosis, carcinoma of the liver. At autopsy, cancer of the lung and liver were found, together with tuberculosis of the mesenteric glands.

CASE XLVI.—Clinical diagnosis, locomotor ataxia with empyema. One liter of pus was found in the pleural cavity at autopsy. There was one positive and two negative examinations of the sputum for tubercle bacilli.

CASE XLVII.—Clinical diagnosis, general glandular enlargement. Spreads from an inguinal gland removed during life showed tubercle bacilli, and spreads from mesenteric gland removed at autopsy also contained tubercle bacilli. At autopsy there was no pulmonary tuberculosis, but a purulent peritonitis, with general enlargement of all lymphatic structures. No intestinal ulcers.

CASE XLVIII.—Clinical diagnosis, typhoid fever. At autopsy, tuberculous ulcers were observed; no pulmonary lesions.

CASE XLIX.—Clinical diagnosis, tuberculous peritonitis. Operation disclosed fibrinopurulent peritonitis. Numerous miliary

tubercles on visceral and parietal layers of the peritoneum were observed, but no intestinal ulcerations could be made out.

CASE L.—Clinical diagnosis, malaria. Patient had chills, fever, and sweats, occurring almost daily for ten days. Examination of the blood on several occasions failed to demonstrate the malarial parasite.

CASE LI.—Clinical diagnosis, meningitis. Child, eighteen months old; no pulmonary symptoms. Tubercle bacilli were demonstrable in the spinal fluid about the same time they were found in the feces.

CASE LII.—Clinical diagnosis, cervical lymphadenitis. Upon the second examination and after a very careful and prolonged search a few tubercle bacilli were found in the feces.

CASE LIII.—Clinical diagnosis, eutaneous tuberculosis (lupus). Although tubercle bacilli were found in the feces, no pulmonary lesions could be made out.

CASE LIV.—Clinical diagnosis, diarrhoea alternating with constipation. No autopsy.

CASE LV.—Clinical diagnosis, gunshot wound of the chest penetrating the lung. On five occasions the sputum was examined for tubercle bacilli, but with negative results. At autopsy a large cavity was found which was surrounded by gangrenous tissue, and on the margin, upon histological examination, tubercles were found which showed few tubercle bacilli.

CASE LVI.—Clinical diagnosis, tumor of testicle, probably tuberculous. The organ was removed and histologically presented a typical picture of tuberculosis. No pulmonary lesions were evident. It might also be mentioned that tubercle bacilli were found in sections of the organ and also in spreads before fixation.

CASE LVII.—This case was one in which a large, ulcerating mass was present in each groin, following the inguinal glands. The condition had persisted for two years. Tubercle bacilli were found in the feces, though the condition had been diagnosticated as sarcomatous, specific, and tuberculous. Sections of the masses studied histologically showed typical tubercles and giant cells and tubercle bacilli.

Besides these cases just cited there were 9 cases of chronic diarrhoea, some of which, upon autopsy, showed tuberculous ulcers and others did not. In a few of these latter cases slight pulmonary involvement could be made out, while in the greater number no pulmonary lesions were demonstrable.

CONCLUSIONS. 1. No acid-fast bacillus other than the tubercle bacillus was found in the feces.

2. The presence of the tubercle bacillus in the feces means that active tuberculosis exists somewhere in the body.

3. In acute miliary tuberculosis the bacillus is always present in the feces.

4. In all cases of chronic diarrhoea and in cases of general glandular involvement, the feces should be examined for tubercle bacilli.

5. Finding tubercle bacilli in the feces does not mean intestinal ulceration in all cases.

6. In arrested or healed pulmonary tuberculosis no tubercle bacilli are found in the sputum or the feces.

7. The feces should be studied for tubercle bacilli as a part of the routine examination, especially in suggestive cases and when no expectoration can be obtained.

I wish to extend my thanks to the various resident pathologists at the Philadelphia General Hospital for their valuable coöperation.

ACUTE INTUSSUSCEPTION IN THE ADULT.

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INTUSSUSCEPTION, although far more common in children, occurs with sufficient frequency in the adult to warrant a careful study of the causes, pathology, and results. One-third of all cases of intestinal obstruction are due to intussusception. In 1000 cases of acute intestinal obstruction reported by C. L. Gibson,¹ 187 were due to intussusception, 121 to volvulus, 354 to hernia, 42 to Meckel's diverticulum, 40 to gallstones, 34 to openings, 16 to foreign bodies, 20 to miscellaneous causes. Leichtenstern² found 442 cases of intussusception in a collection of 1152 of intestinal obstruction, excluding congenital obstructions, stenosis of the rectum, and the various forms of hernia. The exact proportion of cases in children and adults is about 65 to 35. It is the most common cause of intestinal obstruction in children, and one of the most uncommon in adults. Treves gives the following table of frequency by age for acute intussusception: Before the age of eleven years, 53 per cent.; between eleven and twenty years, 12 per cent.; between twenty-one and forty years, 20 per cent.; between forty-one and sixty years, 11 per cent.; beyond sixty years, 4 per cent. or less. Sixty-five per cent. of all cases occur before the age of twenty, and 53 per cent. before eleven years. Twenty-five per cent. occur during the first year of life. In chronic intussusception the percentage differs: 50 per cent. of this class of cases occurs between twenty-one and forty, and only 25 per cent. under eleven years.

There are three anatomical varieties of intussusception: enteric, colic, and ileocolic. Of those occurring in the region of the ileocecal valve there are three forms: ileocecal, ileocolic, and a combination of these, called by Leichtenstern, iliaco-ileo-colica. The most common form of invagination is the ileocecal, the most uncommon being the ileocolic; the other varieties coming between these two in the order of enteric and colic.

Invaginations of the small bowel rarely occur in the upper portion of the intestinal tract, although a case is reported of the presence of duodenum in the invaginated portion of an ileocecal intussusception.³ In one of our cases the invagination was of the jejunum, about three feet from the duodenal junction. Most enteric invaginations occur in the lower portion of the jejunum, next in frequency being the ileum, in about the proportion of 4 to 1.⁴ In our first case the amount of gut invaginated was about three inches long, and this corresponds with the general experience of observers, that enteric invaginations usually involve relatively small portions of gut. The shortness of the invaginated portion does not interfere with the severity of the symptoms, or with a fatal termination if the condition be unrecognized and unrelieved.

Any portion of the large bowel may be involved in the colic variety of intussusception: the ascending into the transverse, the transverse into the descending, the descending into the sigmoid, or the sigmoid into the rectum. Colic intussusceptions are necessarily short, as the large bowel is fixed by its short mesentery.

Ileocecal intussusception is the commonest form. The ileocecal valve forms the apex of the invaginated portion of bowel. The ileum does not pass through the valve, but pushes the valve ahead of it. This form may attain great size. Cases are on record in which the valve traversed the entire length of the colon and presented itself at the anus, and even protruded through the sphincter. In the ileocolic variety the terminal portion of the ileum invaginates, passing through the ileocecal valve. The valve and cecum remain at their normal position and only later are carried into the colon. The third variety, iliaco-ileo-colica, is a combination of the ileocecal and the ileocolic, and is really an advanced stage of the ileocolic, in which the ileum is first protruded through the valve or down to it, and the cecum is then forced with the invaginated ileum into the colon.

The cause of all intussusception of the bowel is irregular muscular action, the muscles in the wall of bowel acting normally in one portion, while in an adjoining portion muscular action is abnormal, due to one of several causes. This abnormality may be a limited but severe muscular action, or a total muscular paralysis—spasmodic invagination and paralytic invagination. The experiments of Nothnagel have placed the pathology of intussusception on a fairly

³ Dr. Delipini, Path. Soc. Trans.

⁴ Treves, Int. Obstruction, p. 144.

firm basis. He demonstrated the two forms, spasmodic and paralytic, in rabbits. In the spasmodic form the circular muscular fibers were made to contract, narrowing the lumen of the gut, while the adjacent bowel remained normal in size and activity. When he stimulated the bowel to the stomach side of the contracted portion, nothing happened. When, however, the bowel to the lower side was stimulated, the longitudinal fibers, by their contraction, caused the normal bowel to turn in on itself causing a progressive descending invagination, in which the contracted portion of bowel did not take place. The same thing occurred when the bowel was totally paralyzed by crushing. When an intussusception increases in length it does so at the expense of the sheath. The method of increase of the invaginated portion of the ileum in the ileocolic variety is different from the other varieties of intussusception; here the ileum protrudes through the ileocecal valve and meeting no resistance in the large cecum, grows by the protrusion of more and more ileum, and not at the expense of the sheath, the limit being reached by the length of the mesentery. Clinically, the spasmodic variety is the only one met with, and the vast majority are descending invaginations. Retrograde or ascending invaginations occur, but are of short duration and a very small portion of bowel is invaginated. As a rule, they reduce themselves and are, therefore, not often recognized although often suspected as the cause of transitory intestinal colic. Double and triple intussusception also occur but rarely. A recent reported case will be recited later.

Irregular muscular action of the intestinal muscularis is the requisite for intussusception. The causes which give rise to the irregular action are, ptomaine poisoning, enteric fever, traumatism, growths of the bowel, benign and malignant. Ptomaine poisoning, causing, as it does, violent action of the muscle of the bowel by the local irritation, and this action being irregularly distributed through the bowel, gives rise to the majority of cases of intussusception. The vast majority of cases of intussusception occur in children in the milk-feeding period. Impure milk is an extremely common cause of intestinal poisoning, hence we can reason from cause to effect. This frequency in children of intestinal colic due to infection, plus the increased mobility of the large bowel, is corroborative of this opinion. In the adult intussusception from ptomaine poisoning is less common. The following case is in point:

G. M., agent, aged twenty-seven years, was referred to the German Hospital, August 3, 1905, by Dr. George Y. MacCracken. On August 1 he had eaten deviled crab and watermelon; he said the crab was bad. Several hours later he had a severe abdominal pain, colicky in character, and associated with vomiting. His abdomen was scaphoid, but there was no tenderness or rigidity. Morphine did not relieve the pain. Castor oil did not produce a stool. On the following day his abdomen was still scaphoid, with general tenderness,

but no rigidity and no tumor could be made out; he was still vomiting and there was no bowel movement. He was admitted on August 3, with marked symptoms of intestinal obstruction. No tumor could be made out on account of the abdominal distention. Pulse 108; temperature normal. He had an anxious expression and his appearance was of one suffering from profound toxemia. Dr. MacCracken had diagnosticated ileocecal intussusception. His abdomen was rapidly opened and the diagnosis proved to be correct, except that it was an ileocolic invagination. It was impossible to reduce the invagination, which involved a large segment of the ileum, probably eighteen to twenty inches, and so an ileocolotomy with a Murphy's button was hastily performed. The man's condition forbade any further procedure. He lived but a few hours and died of shock and exhaustion.

We believe the exciting cause of this case was ptomaine poisoning from decayed crab meat.

That intussusception occurs during the course of enteric fever is proved by the following recorded cases, which have come to notice since the practice of opening the abdomen for perforation or suspected perforation has come into vogue. Lieutenant-Colonel Jennings,⁴ R. A. M. C., reports 2 cases occurring during enteric fever, giving rise to symptoms similar to perforation. The true condition was not discovered in either case until the necropsy was performed.

Ash⁵ reports two cases, one in which six inches of ileum had slipped into the cecum. Operation six hours after the onset of symptoms. The patient, a soldier, aged twenty-five years, on the ninth day of a relapse was suddenly seized with acute abdominal pain which passed away only to return in an hour with vomiting and marked rigidity, but without distention. The pain was referred to the umbilicus and epigastric region. Under anesthesia a mass could be felt in the right iliac fossa which was dull to percussion. The patient was operated upon, the intussusception was reduced and the patient made an uninterrupted recovery. The second case reported by the same author, was discovered at postmortem; the third case was operated on by one of us (Ross), November 25, 1903, at the German Hospital.

Dr. J. C. Wilson speaks of invagination of the bowel occurring during the course of enteric fever, but relates no cases. This statement was probably founded on postmortem findings. Hart and Ashhurst⁷ speak of having seen it occur during an attack of ambulatory typhoid. B. L. Bryant and J. S. Bragg⁸ report a case, occurring in a man, aged twenty-three years. Ordinary course of typhoid fever. In fourth week sudden abdominal pain, localized in right iliac fossa. Pain intense, skin moist, small bowel movement. Temperature, 102°; pulse, 120; respiration, 24. Abdomen became very tender,

⁴ British Medical Journal, 1902, 1, 1053.

⁷ Annals of Surgery, January, 1904.

⁸ Med. Record, November 18, 1905, p. 818.

⁵ British Medical Journal, May 3, 1902.

most intense one inch above McBurney's point. One hour after attack, pulse 145, and weak. Abdomen not distended. Patient quiet. Diagnosis, perforation. Operation: three intussusceptions both ways: the first a short distance from ilcoecal junction was eight inches long and easily reduced; the second, five inches long, a short distance from the first, was also easily reduced; and a third, three inches long, also in the ileum, was discovered. Patient died five hours after operation.

Two cases have been operated on at the German Hospital. The first has been reported by one of us (Ross⁹), and the other was operated on by Dr. Deaver.

CASE I.—W. B., a male, aged seventeen years, in a severe attack of typhoid fever (with hemorrhages), was awakened on the twenty-sixth day with violent abdominal pain. He was thought to have perforation of the intestine, but operation disclosed an intussusception three inches from the junction of the duodenum and the jejunum. This was readily reduced, and although he had later hemorrhages, he made a good recovery. (Details of the case history may be found in the original report.)

I do not believe that there is a special pathological cause for intussusception under these circumstances, except it be the lack of muscular tone due to inflammatory infiltration of the bowel wall in localized areas, permitting a greater degree of distention in different portions of the bowel.

CASE II.—Miss J. S., aged nineteen years; single; a wireworker, was admitted February 27, 1906, on the nineteenth day of the disease, and was discharged on May 20, 1906. Diagnosis: enteric fever. Complications: hemorrhages, intussusception. Operation: reduction. Relapse: cholecystitis. Sequel: neuritis, with foot drop.

The family history is negative.

Previous History. The patient had measles, pertussis, varicella, and pneumonia (at six years). Menstruation established at fourteen years; regular but painful.

For several months she had felt indisposed and low-spirited. For two weeks before admission she had been confined to bed with high fever (according to her statement). Vomited once; had slight abdominal pain and some diarrhoea. No epistaxis; no cough, but considerable expectoration.

The physical examination was negative, except that the spleen was enlarged to percussion. No rose spots were found. On March 2, the Widal was negative, and on the 13th it was positive.

On the twenty-first day of the disease, three days after admission, and on the two subsequent days the patient had hemorrhages. There were eight bloody stools, amounting to 2040 c.c. The temperature dropped 8° F., from the evening of the twenty-first day to

⁹ Surgical Complications of Typhoid Fever. AMER. JOUR. MED. SCIENCES, 1905, cxxx, 115.

the morning of the twenty-third day of the disease. There was a rise again until the temperature reached 101.8° F. on the twenty-seventh day. Then followed a gradual decline until, on the evening of the thirty-fifth day, the record was 98.4° F. From this time there was another rise to 103.4° on the thirty-ninth day. On the fortieth day, at 2 A.M., the patient had some abdominal pain and vomited a yellow fluid with some mucus. At 11 A.M. she passed a small, liquid stool containing bloody mucus. At 2 P.M. the pain in the abdomen grew worse. At 5 P.M. another stool containing shreds of bloody mucus was passed. Later there were several more stools with streaks of blood and mucus. There was considerable tenesmus. During the day patient vomited six times. The vomitus changed from a yellow at 2 A.M. to light green at 5 A.M.; dark green at 11 P.M.; brown at 4.30 A.M. on the forty-first day; dark brown with fecal odor at 11.30 A.M. On the forty-first day, at 8 A.M., the abdominal pain became very severe, peristalsis was greatly increased. The leukocyte count was 11,000. A diagnosis of intussusception was made and the patient was transferred to the surgical department for operation.

Operation. Dr. Deaver. Chloroform. Vertical incision 9 cm. long in the outer margin of the right rectus muscle. Upon opening the peritoneum, the cecum was found to be collapsed. The ileum was very much injected and distended. A large ulcer was found in the ileum near the cecal junction and an intussusception at this point. The cecum was the intussusciens, and 25 cm. of the ileum the intussusceptum. The ileum was withdrawn without difficulty. The patient reacted well from the operation. From the forty-first to the forty-sixth day her temperature ranged from 101.4° to 103.4° F. On the forty-sixth day she was transferred to the medical department with a relapse. The temperature was 103° F. She was weak and restless, pulse rapid and feeble, the respirations frequent.

On the fiftieth day the stitches were removed. Wound in fine condition. Hemorrhage from left nostril. Bowels quite free. Pulse rate 152. On the fifty-ninth day the gall-bladder became painful, tender, and palpable. Some cough. On the sixty-sixth day she developed a neuritis in the right leg with subsequent foot-drop. On the seventy-third day the temperature reached normal and remained normal until the patient's discharge from the hospital on the one hundred and second day. She still suffered with partial foot-drop, but otherwise was in good condition.

For 2 cases illustrating traumatic intussusception and that due to malignant growths we are indebted to Dr. Francis T. Stewart, surgeon to the Germantown Hospital. The notes as given by Dr. Stewart are as follows:

Traumatic Intussusception. N. G., aged thirty-six years, was struck just above the crest of the left ilium by a heavy steel beam. Shortly afterward he was admitted to the Germantown Hospital in the most profound shock. At the end of twenty hours his tempera-

ture had risen to normal and the pulse had fallen to 110. He had vomited twice and had passed twelve ounces of bloody urine. There was great pain all over the abdomen, a large hematoma in the left loin, and intense rigidity of the abdominal muscles. Liver dulness was decreased by three fingers' breadth, and no dulness could be detected in the flanks. The abdomen was opened in the middle line below the umbilicus and a large extraperitoneal extravasation of blood found extending from the bladder, whose walls were infiltrated with blood, to the left kidney which was normal to palpation. The abdominal muscles on the left side were torn from the left iliac crest. The peritoneal cavity was opened and found to be clean; there was no visceral rupture. In numerous places the small intestine was tightly contracted, the areas involved varying greatly in extent, so that in certain regions the intestine seemed to be ligatured, while in others it resembled a piece of tape. In one place the contracted intestine had passed into the relaxed segment below for a distance of two inches. The intussusception was reduced, the peritoneal cavity closed, and the extraperitoneal tissue drained. The patient died four hours later of shock.

Intussusception due to Malignant Growth. C. H., aged forty years, had sarcoma of the iris removed about nine months ago and later the eyeball for recurrence. Now has general melanotic sarcomatosis. He was admitted on April 7, 1906, with severe abdominal pain and non-fecal vomiting for twenty-four hours, elongated mass in right side of abdomen becoming harder with colic, no blood or mucus from rectum, no distention; bowel movements have been growing smaller for the past two or three days. Incision on right side, intussusception about one foot long of ileum into ileum, apex of the intussusception entering colon and reaching hepatic flexure, the apex of the intussusception being formed by a tumor about one-half inch in diameter in the bowel wall. This, as well as several other tumors, showed marked umbilication. Intussusception reduced with difficulty. Recovery from operation uneventful.

The diagnosis of acute intussusception in children is less difficult than in the adult. In children it is the most common cause of intestinal obstruction, and children are very much less liable to inflammatory affection of the peritoneum and abdominal organs, thus offering less obscurity to the trouble. It must be remembered that all acute intussusceptions do not progress to obstructive conditions. It is probable that a very large percentage of attacks of acute severe abdominal pains are due to temporary, short invaginations which quickly relieve themselves by unfolding, the incarceration being short-lived.

The onset of the attack is usually sudden. Treves thinks that 75 per cent. of acute cases have a sudden onset. There is usually evidence of some one of the predisposing causes preceding the seizure.

This is more commonly noted in adults, as we have the benefit of the individual's ability to state the circumstances relating to the attack. The mode of onset is influenced by the portion of the bowel involved. In the ilcoecolite the commencement is always sudden, while that of the large bowel is most often gradual. In patients who give no apparent cause for an attack, stating that they were in perfect health up to the time of onset, it is well to investigate carefully the food ingested during the preceding twenty-four or forty-eight hours, for we believe that a satisfactory explanation, namely, ptomaine poisoning, will be found to account for the 52 per cent. in which no evident exciting cause has been offered.¹⁰

The most persistent and also the first symptom is pain. It may reach its maximum intensity when the invagination occurs and then moderate, although it is usually more gradual, becoming more and more severe until the parts become fixed or gangrenous, when the pain diminishes or ceases altogether. This tendency to diminish in intensity is significant and should always lead to a suspicion of the trouble. The character of the pain is colicky and intermittent at first, becoming more constant as the obstruction progresses. This is in accordance with the rule that intermittent pain almost invariably indicates partial obstruction, while in complete obstruction the pain is constant and more severe and without marked exacerbations. In the incomplete obstruction the pain may not completely disappear, but there are distinct exacerbations. The pains are at first general and ill defined, becoming localized later. Invaginations of the small bowel give rise to more intense pain than those of the large bowel, due to the greater muscular development of the former. The location of the pain is indefinite until the invagination becomes fixed, when it localizes to the area of bowel involved.

Vomiting is most common in the acute intussusception. It is not so severe as in other forms of intestinal obstruction, and does not appear as early, nor is there the same tendency to stereoraceous vomiting. It is likely to occur in intervals and gives great temporary relief. This temporary relief is a characteristic feature of intussusception. As a rule the higher the invagination the more severe the vomiting.

Rigidity of the abdominal muscles is not met with in intussusception in the early stage, coming on only after peritonitis has set in. Distention is also absent in the majority of cases, only making its appearance late in the attack when the obstruction is complete, or marked peritonitis supervenes. In cases in which marked diarrhoea is an early symptom the belly is apt to be scaphoid. Tenderness is a late symptom and indicates peritonitis. In the early stages pressure offers distinct relief.

The presence of a tumor, which in children and in chronic intus-

¹⁰ Treves' table of Intestinal Obstruction, p. 178.

susception is of great diagnostic value, is not met with so often in acute cases in the adult. Leichenstein found a tumor present in about 50 per cent. of all cases in all ages. It is most frequently met with in the cecal and ileocolic varieties. In none of our cases was a tumor demonstrable. When present it may be discovered through the abdominal walls or in the rectum. It varies in size with the size of the intussusception, but never gives an idea of the actual amount of bowel invaginated. It is usually hard and resisting. It is also usually more prominent during attacks of pain and sometimes has a distinct range of motion.

The temperature, as a rule, remains normal or slightly above normal, except in cases associated with shock. Collapse, however, is far less common than in obstruction due to bands. It is far more common in young infants and is then rarely fatal. Tenismus in acute and subacute attacks is a severe, early, and constant symptom. The nearer the invagination is to the anus the severer the tenismus. It may or may not be associated with blood or blood-stained mucus. Thirst in intestinal obstruction depends upon the degree of vomiting, hence is less marked in intussusception than other forms of strangulation.

We believe that operation is the safest and most logical procedure in the treatment of acute intussusception. To have the best results early diagnosis and prompt action are essential. Any attempt to reduce a well-defined intussusception by the use of forced enemas is in our opinion losing valuable time.

PRIMARY CARCINOMA OF THE URINARY BLADDER.

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A REVIEW of the literature has failed to reveal a recent report of any considerable series of cases of primary carcinoma of the bladder thoroughly studied from both the clinical and the anatomical sides. Going back a few years there is no lack of material from which to draw, and it is from this source that most of our literature is derived. The marked discrepancies in the statistics and in the statements of the various authors would lead one to infer that most of the original literature will not bear a very close inspection, and this is to a certain extent borne out by the facts. Carcinoma of the bladder is a hidden disease. One cannot note its beginning and watch its progress from day to day. Furthermore, its location and malignant nature make its clinical manifestations peculiarly subject to confusion with those of complicating or neighboring diseases. Such being the case, it is

very evident that statistics gleaned from the records of the clinician and the surgeon may be very inaccurate, and the inferences based thereon no safe guide. On the other hand, the conclusions of the pathologist and the microscopist, widely at variance with those of the practitioner, need comparison with the reports of the latter.

The above considerations have furnished me with the excuse for the report of the following series of 10 cases, the records and specimens of which are in the pathological laboratory of Rush Medical College. I wish to emphasize the fact that the report is based primarily upon postmortem examinations, supplemented in each case by a careful microscopic examination, and as far as possible, by the clinical data. In each instance the following questions were answered in the affirmative: (1) Is the tumor malignant? (2) Is it a carcinoma? (3) Is it primary in the bladder?

The ultimate standard of malignancy was that set by Ziegler; namely, infiltration of the bladder wall or the formation of metastases. Parenchymatous infiltration of the muscularis was demonstrable, microscopically, in every case; the epithelial character of the tumor was established by the histological appearance; and, without exception, we were able to exclude the possibility of prostatic or other extravescical origin.

CASE I.—A man, aged thirty-nine years. The clinical history was not to be obtained. At the autopsy was found: "a condition of right pyonephrosis and left hydronephrosis; the left ureter is dilated to the size of a lead pencil. The bladder contains a grayish-brown, purulent fluid. The inner wall is studded with nodules, varying in size from that of a split pea to a walnut. The prostatic urethra is invaded and a tumor, situated on the trigone, obstructs the ureters." A study of microscopic sections showed the growths to be papillary carcinomas with extensive necrosis, and with finger-like projections extending down into the muscular wall.

CASE II.¹—J. S., male, aged forty-six years, a musician, was first admitted to the Presbyterian Hospital in the summer of 1901, complaining of pain and strangury on urination. At that time a diagnosis of cystitis was made. After his discharge the patient's symptoms increased in severity and he lost flesh. He developed an irregular fever with occasional chills. He returned to the hospital, and was operated on March 26, 1902, a suprapubic incision and perineal drainage being performed. Several small calculi were removed from the bladder, and a diagnosis of carcinoma was made from the scrapings. Two days later a blood examination showed a rather marked anemia with a color index of 0.6, and a leukocytosis of 18,000. The urine was acid until a few weeks before death, when it became alkaline. Death occurred April 30.

The postmortem examination showed a secondary involvement

¹ Reported in Trans. Chicago Path. Soc., 1902, v, 105.

of the retroperitoneal, pelvic, and mesenteric lymph glands and growths in the lungs and liver. In addition there was an ascending cysto-uretero-pyelonephritis with dilatation of the ureters and renal pelves on both sides. The entire inner surface of the bladder wall, including the urethral and both ureteral orifices, was invaded by tumor tissue, which projected in large, necrotic masses and showed extensive ulceration. The anterior wall was adherent to a subperitoneal carcinomatous mass and was torn in separating the organ from the symphysis. A perforation appeared to have taken place at that point and to have been walled off by adhesions. Microscopic examination showed that the growth was what may be described as a pseudotubular carcinoma, the cells being, for the most part, arranged in solid cords and nests, but showing in places the appearance of imperfect tubules. The muscular wall was extensively infiltrated.

CASE III.—H. K., male, aged forty-four years, was admitted to the Norwegian Tabitha Hospital. The patient gave a history of gonorrhoea at twenty-two years. This was closely followed by strictures, cystitis, and pyelonephritis. Two years later a urethrotomy was performed, after which he enjoyed good health until the spring of 1901. At that time urination became frequent and painful. In January, 1902, he fell on his right hip. Two months later a small, hard tumor developed in the region of the right sacro-iliac joint, the urinary symptoms in the meantime growing progressively worse. An operation was performed for the removal of this osteal tumor on May 5. The patient developed an irregular fever after the operation and died May 27, 1902. The urine was acid throughout and contained a large amount of albumin and numerous pus cells.

The autopsy revealed: "A carcinoma of the bladder with metastases in the right iliac bone, left eighth rib, right second and ninth ribs, liver, mesenteric, retroperitoneal, inguinal, and peribronchial lymph glands. Two of the affected ribs have become fractured. There is an ascending pyelonephrosis with dilatation of the right ureter and renal pelvis, and also a psoas abscess. The bladder contains a large amount of gravel glued together with mucus and adherent to the mucosa in the form of balls. The tumor, as a diffuse thickening of the bladder wall with projecting ridges 1 or 2 cm. in width at the base, occupies almost the entire lower one-third of the bladder and extends up on the right wall. Both ureteral orifices are involved in the tumor mass, the right being completely closed. The projecting point of one of the ridges partly blocks the internal urethral orifice. The prostate is smooth externally and of normal size. The tumor is of rather hard consistency and is not ulcerated." The microscope showed the muscularis to be extensively infiltrated. The sections presented the appearance of a papillary carcinoma, with cords of cells arranged in a glove-like, or arborescent manner.

CASE IV.—O. C., male, aged forty-three years, a farmer by occupation, admitted to the Presbyterian Hospital, gave a history of gonorrhœa nineteen years before his present trouble began. He denied other illnesses. In November, 1901, his first symptoms developed: frequent urination accompanied by a burning sensation. His symptoms grew more severe, he lost weight, and at the time he entered the hospital was having occasional chills accompanied by an irregular fever. There was a slight pyuria and hematuria. The reaction of the urine was alkaline. A blood examination showed the red cells to be 3,912,000; the white cells, 8050; the hemoglobin, 55 per cent. A nephrotomy was performed. The patient survived this operation two weeks, dying November 23, 1902.

The postmortem findings were: "A primary carcinoma of the urinary bladder, with secondary involvement of the kidneys, adrenals, lungs, and left testicle. There is an ascending cysto-ureteropyelonephritis, and a right perinephric abscess. A stone is impacted in the lower portion of the right ureter; the proximal end of the ureter and the pelvis of the kidney are dilated. There is a slight stricture of the membranous urethra. The external urethral orifice opens at the junction of the glands with the corpus spongiosum." "The upper four-fifths of the bladder wall shows an extremely necrotic, ulcerated, greatly thickened, lining. Superficially the growth is nodular and fungoid. It extends to within 1 cm. of the urethral opening, while the ureters open just below the margin of the tumor mass." The prostate and seminal vesicles were not involved. Microscopically the tumor was found to be a typical papillary carcinoma which had very extensively infiltrated the bladder wall.

CASE V.—H. M., male, aged seventy-two years, was admitted to the Norwegian Tabitha Hospital, to the service of Dr. Sandberg. The family history was negative and the patient denied venereal disease. He had been in good health up to October 15, 1902, when his first symptoms began: severe, lancinating pains in the back and abdomen, radiating to the right thigh and testicle. These continuing, he was admitted to the hospital on November 17. At that time his urine was acid, contained much albumin and numerous red cells. He had no fever. On November 22, about one-half of the bladder, comprising the greater part of the anterior wall, was resected. There was no fever subsequent to the operation, but persistent nausea and vomiting developed, and death supervened December 24.

At the postmortem a considerable necrosis of the bladder wall was found near the operation wound. There was a general, acute, fibrino-hemorrhagic peritonitis, and an acute cystitis and urethritis. Metastatic tumors were found in the liver, lungs, and the right eighth rib, which had sustained a pathological fracture. The ureters and kidneys were practically normal. Quoting from the records, "The left lobe of the prostate is 4 by 2.5 cm. The cut surface is slightly gelatinous; the right lateral lobe answers the same description."

The microscope showed no indication of tumor formation in this organ. Sections of the bladder wall showed that it was deeply infiltrated by tumor cells, evidently those of a papillary carcinoma, of the rapidly-growing type and with a marked tendency to degenerative changes. The secondary tumors were similar to this in character.

CASE VI.—P. J., male, aged thirty-eight years, was admitted to the Presbyterian Hospital to the service of Dr. Robison. No statement as to previous diseases was obtained. The patient was ill in May, 1902, with an affection diagnosed as "malaria." His urine was bloody and there was frequent and painful micturition. The following winter the hematuria again appeared, and the patient became weak and emaciated. He entered the hospital, and the diagnosis of carcinoma of the bladder was made. Toward the close he developed gastro-intestinal "distress" and a cough. A blood examination showed: red cells, 3,880,000; white cells, 14,800; hemoglobin, 45 per cent.

Only the contents of the abdominal cavity were examined post-mortem. Metastatic tumors were found in the liver, mesenteric, and retroperitoneal lymph glands. There was ascites and slight prostatic hypertrophy. A tumor, composed of flat, sessile, soft projecting masses, occupied the inner surface of the posterior wall of the bladder, beginning 3 cm. above the upper border of the prostate and extending to the highest point of the bladder. The tumor showed an extensively ulcerated area and was covered in part by a thick layer of gravel. On microscopic examination both the muscular wall and the serous covering of the bladder were found to be infiltrated with strands and clusters of tumor cells, the arrangement justifying the classification of papillary carcinoma.

CASE VII.—C. E., male, aged sixty-four years, was admitted to the Presbyterian Hospital. This patient, a bricklayer, denied venereal infection, and said that he had used alcoholic drinks in moderation. He gave a history of excellent health up to April, 1903, when urination became difficult, frequent, and painful. On his entrance into the hospital July 16, 1903, his bladder was distended with bloody urine. Rectal examination revealed a prostate the size of a lemon. His temperature was 100.2°. A blood examination showed a red count of 4,670,000; leukocytes, 5200; and hemoglobin, 52 per cent. A prostatectomy was performed July 21. Fever and severe chills followed, and death ensued three days later.

Among the anatomical findings were, "Ulcerative carcinoma of the urinary bladder with secondary involvement of the pelvic and retroperitoneal lymph glands, including a gland at the bifurcation of the aorta." The tissues were all distended by gas generated by the *Bacillus capsulatus aërogenes*.

Quoting further from the autopsy records, "A large tumor mass measuring 14 by 10 cm., made up of a large number of projecting

nodules and partially ulcerated, occupies the whole trigone and the lower part of the bladder. The ureteral papillæ are greatly hypertrophied and project up like horns flattened against the posterior wall of the bladder. About 5 cm. below and a little internal to the right ureteral papilla is a triangular fistula through the tumor mass, entirely perforating the posterior wall of the bladder. The prostate has been removed by operation leaving an opening in the anterior portion of the bladder. In removing the prostate a part of the tumor was also cut away. The ureters are not involved by the tumor down to the point at which they enter the vesical wall. Both ureteral openings into the bladder are greatly stenosed, but not entirely occluded. The left vas can be traced into a tumor nodule lying on the border of the perforation in the posterior wall of the bladder. The left seminal vesicle is apparently surrounded by tumor tissue; the right seminal vesicle is contained in a tumor nodule at the edge of the perforation. The microscopic sections showed such advanced necrosis that it could not be positively determined to which type the carcinoma belonged, the infiltration of the muscularis, however, being very evident.

CASE VIII.—Mr. M., aged fifty-six years, a tailor, was admitted to the Presbyterian Hospital. The patient denied venereal disease and gave no other pertinent history. Ten months before death he developed hematuria. Later he complained, in addition to incontinence, of frequent urination with a burning sensation, and of pain in the back. On his entrance into the hospital his urine was neutral in reaction, and contained blood, casts, and much albumin. His symptoms gradually grew worse, he became emaciated and developed a slight fever toward the close.

The postmortem revealed a left suppurative ascending cystouretero-pylonephritis; dilatation of both ureters, with stenosis and kinking of the left. The bladder was occupied by a soft, fungus-like, tumor mass, 9 by 6 cm., which showed extensive necrosis. The tumor was attached to the bladder wall along the right side, the area of attachment beginning above the trigone. The ureteral and urethral orifices were involved only by the pressure of the tumor. There were no metastases and no involvement of neighboring structures. The anatomical diagnosis of papillary carcinoma was verified by the microscope.

CASE IX.—J. R. C., male, aged fifty-five years, a sailor by occupation was admitted to Cook County Hospital, November 2, 1906. A history was given of hematuria for seven months. At first there were no other symptoms, but seven weeks before admission pains developed in the region of the bladder with a rapid decrease of weight and strength. On examination the patient's pulse was found to be rapid; and the abdomen below the navel was tense. He was catheterized and 500 c.c. of bloody, foul-smelling urine, containing shreds of tissue was drawn off. There is no record of examination

of these shreds. The examining-room diagnosis of urinary retention was made. Death occurred three hours later.

The postmortem, held by Dr. Hunter, the Coroner's physician, revealed a carcinomatous growth in the bladder, ascending pyelonephritis, and a right psoas abscess. "There is no involvement of the prostate and no metastatic growths. The tumor, situated on the right anterior part of the bladder wall, forms a hard, slightly ulcerated, almost spherical growth 5 cm. in diameter, projecting into the cavity of the bladder. It is connected to the wall by a pedicle, of softer consistency, 3 cm. in diameter. The muscularis at the site of attachment shows extensive infiltration. The right ureteral orifice as well as the urethral is pressed upon by the tumor." The diagnosis was confirmed by the microscope, the epithelial cells being arranged in several layers about a frame work of branching connective-tissue stroma.

CASE X.—J. D., male, aged forty-five years, admitted to the Presbyterian Hospital. The family history was negative. The patient had gonorrhœa at the age of twenty years, and syphilis at twenty-three years, having taken specific treatment for ten years thereafter. In the fall of 1904, after taking cold, he had an attack of severe pelvic pains and frequent urination, lasting for one week. He noticed no further symptoms until six months afterward, when he passed numerous small stones and had two chills. After the removal of eight larger calculi per urethram the concomitant tenesmus and pain subsided; but set in again June 16, 1906, and gradually increased in severity. There had been, however, no hematuria observed and no other abnormal appearances in the urine, except a "ropy substance" during the first attack. Eight weeks before his entrance into the Presbyterian Hospital an operation was performed for vesical calculus and one stone was removed.

Examination on admission showed a vesical fistula. The prostate was enlarged and tender. The urine was alkaline, with a specific gravity of 1010, and contained much albumin, many pus cells, and a few erythrocytes. During the first few days the temperature was irregular, ranging from subnormal to 102°. On October 8, an operation was performed in hopes of removing the tumor. During the next two weeks there were several severe rigors; nausea and diarrhœa developed, and the patient grew gradually weaker, dying November 23.

The pertinent postmortem findings were as follows: "Almost the entire bladder wall above the trigone is diffusely infiltrated by a firm tumor mass, and measures 1 cm. in thickness. From the interior of this part of the bladder extend numerous rounded, oval, and tongue-like projections, the largest being the size of a bean. Both urethral orifices are encroached on by the margin of the tumor. The seminal vesicles and the prostate are not involved. The mucosa of the trigone is dusky, and shows small superficial ulcerations.

There is a condition of double pyonephrosis. Both ureters are markedly distended, measuring, when laid open, from 3 to 5 cm. in circumference. The right ureter contains a stone. On the right side is an accessory ureter extending from the pelvis of the kidney to a point on the ureter 7 cm. above its vesical orifice. Its lumen is patent throughout. The pelves of both kidneys are much dilated and the kidney substance diminished in thickness. In the left kidney several cavities extend from the pelvis into the cortex to within a few millimeters of the surface." There were no metastases. On microscopic examination the tumor proved to be a papillary carcinoma made up of large cuboid cells with vesicular nuclei and a rather scanty stroma.

A good example of the contradictory statements in the literature is met with in regard to the prevailing seat of the tumors. Barling,² in an analysis of 260 vesical neoplasms, found two-thirds springing from the base. Albarran³ divides the bladder into three parts, the lower being below the level of the ureteral orifices. He affirms that most tumors originate in the middle third, and found only 2 out of 88 springing from the trigone; admitting, however, that of tumors, originating elsewhere one-third extend to the trigone. On the other hand, Clado,⁴ who observed 250 cases of malignant tumor, asserts that their seat of election is the base of the bladder and that extension nearly always takes place in an upward direction, involvement of the rectum, vagina, or prostate rarely taking place, while extension through the muscular wall and intestinal adhesions, consequent on an upward growth, is not at all uncommon.

In our series it could be pretty definitely determined that the seat of origin was in the trigone in three instances. In 1 case (II) it is uncertain whether the tumor had its start in the trigone or in the anterior wall; probably the latter. Three of the tumors showed greatest involvement of the upper part of the bladder while the remainder affected the middle zone more extensively. The urethra was directly involved in the tumor mass in two instances, while in 2 there was partial obstruction by projecting portions of the neoplasms. One or both ureteral orifices were directly implicated in 3 cases, while in 4 others there was partial obstruction by pressure of the tumor or nodules. One tumor (Case VII) had invaded both seminal vesicles, as was demonstrated both by external examination and by serial sections. Of such involvement Clado had not seen an example. None of the growths had extended to the prostate or rectum, and only one had caused perforation into the peritoneal cavity.

As to the frequency of extension to the glands and as to the for-

² International Clinics. Philadelphia, 1894, 4th series, i, 231.

³ Les tumeurs de la vessie. Paris, 1891.

⁴ Traité des tumeurs de la vessie. Paris, 1895.

mation of further metastases there is a wide divergence of opinion. Clado states that of 250 cases of malignant tumor observed in his clinical experience, there were only 4 instances of glandular involvement when the tumor was well localized in the bladder. He also quotes Fere, who in 145 cases found glandular involvement in only 10. Pasteau⁵ asserts that the iliac glands are enlarged in 43 per cent. of all sessile and 85 per cent. of all infiltrating tumors, but that metastasis gets but little further than this. Keyes,⁶ quoting this statement, concludes that "a vesical tumor (carcinoma or sarcoma) remains confined to the bladder for years and rarely gives rise to metastases of any importance."

On the other hand, Albarran, in 16 observations, found glandular involvement 11 times, and Tuffier⁷ in 15 autopsies found 3 instances of propagation to neighboring organs and 11 of glandular infection and generalization. Bland Sutton⁸ testifies to the frequency of involvement of the pelvic lymph glands and of general dissemination.

An analysis of these and other conflicting statements seems to show that, generally speaking, clinicians hold to the view that vesical carcinomas tend to remain localized and form few metastases, although pathologists incline to a contrary opinion. Several factors may be responsible for this discrepancy: The nature of the lymphatic system of the bladder is such that a malignant tumor would naturally tend to remain localized in the earlier stages, which are more likely to fall under the observation of the surgeon than the pathologist. According to Poirier and Charpe, lymphatic vessels probably do not exist in the mucous membrane of the bladder, but the network of origin is intramuscular, from which the efferents lead into a second network between the muscularis and peritoneum or perivesical fascia. The neoplasms are said to originate most frequently in the deeper layers of the epithelium, and the direction of growth is at first naturally along the line of least resistance, toward the inner surface of the bladder. Another factor for this discrepancy is that without a postmortem examination there is a strong probability that metastases, especially in internal organs, will be overlooked. This statement might appear entirely superfluous, did not one meet with so many examples in the literature of attempts to draw conclusions from clinical observations alone. Another factor is the ease with which a benign may be mistaken for a malignant tumor. There are reports of considerable series of operations for the extirpation of "carcinoma of the bladder" with little or no reference to microscopic examinations.

⁵ *Etat du système lymphatique dans les maladies de la vessie et de la prostate.* Paris, 1898, Pp. 46, 52.

⁶ *The Surgical Diseases of the Genito-urinary Organs.* New York, 1899, 259.

⁷ *Traité de Chirurgie.* Paris, 1892, vii.

⁸ *Tumors, Innocent and Malignant.* Philadelphia, 1893.

The following statement by Lincoln Davis⁹ is apropos in this connection: "It is generally conceded that of two tumors which are macroscopically and microscopically indistinguishable, the bladder wall may show infiltration in one and not in the other." Finally, there is abundant evidence that benign tumors may undergo malignant transformation, and it might happen that the observer of the final stages had no knowledge of the long period that the tumor had manifested no signs of malignancy.

In 3 cases of our series no metastases or extravesical involvement was found; in 1 they are doubtful, none being described. In the other 6 cases metastases were present in various organs, as follows: four times each in the retroperitoneal glands and lungs; twice in bones, and once each in the peribronchial glands, inguinal glands, adrenal gland, kidney, and testicle.

The occurrence of metastases in the bones in 2 cases might lead to the suspicion of an error in diagnosis, especially as there is but little reference in the literature to such occurrences. However, the possibility of the tumors being sarcomas or prostatic carcinomas was excluded positively. The secondary tumors in the bones in these 2 cases entitle carcinoma of the bladder to a place in clinical medicine and surgery with the prostatic, adrenal, mammary, thyroid, and uterine tumors.¹⁰

A point deserving of special emphasis is the mode of death. In 7 of our cases this was due to ascending infection of the urinary tract. In each of the 7 cases there was demonstrable blocking of one or both ureters; in 3 by direct involvement and in 4 by pressure. The ureters in several instances were so dilated and their walls so hypertrophied that they resembled more the small intestine than the ureter.

Reference has already been made to the difficulty of diagnosis in primary carcinoma of the bladder. Probably in many cases the condition is not ascertained until postmortem examination. In our series the correct diagnosis was made in 2 cases from the symptoms and physical examination. In 2 other instances it was made after cystotomy for complications, while in 6 the primary tumor was unrecognized clinically.

The reasons for such mistakes, aside from the inherent difficulty of separating symptomatically the various affections of the bladder and contiguous structures, are two-fold. The first is the character of the complications which are especially prone to obscure the diagnosis in the later stages. The other is the character of the early symptoms. In the literature on this subject one meets with the oft-reiterated and much emphasized statements, that painless, copious, repeated, apparently causeless hematuria is a very early symptom; in the majority of cases the first observed by the patient,

⁹ Tumors of Urinary Bladder. *Annals of Surgery*, 1906, xliii, 556-591.

¹⁰ See report by Yoder, Description of an Osteoplastic Metastatic Carcinoma of the Sternum Following a Primary Carcinoma of the Uterus. *Med. News*, December 6, 1902.

and that its character is not far from being pathognomonic. Yet in only 3 of these 10 cases was hematuria, sufficient to be noticed by the patient, an early symptom. One other patient observed blood in the urine in considerable amounts, but some time after the onset of pain and strangury. In the 5 remaining cases whose clinical history was obtainable hematuria was late, and only slight or microscopic in quantity. It would seem that there is no clinical symptom or combination of symptoms by which we can affirm or deny the presence of a vesical carcinoma, and that the only basis for a positive diagnosis is offered us by the cystoscope and the microscope.

CONCLUSIONS. (1) Intelligent deductions and trustworthy statistics are to be derived only from careful and thorough study of a large number of cases from both the clinical and the anatomical sides. (2) The most frequent seat of carcinoma in the bladder and the direction of extension are still debatable questions. (3) Metastasis is much more frequent than is conceded by many clinicians. (4) A malignant growth in the bones may occur from a primary carcinoma of the urinary bladder. (5) The most frequent cause of death in vesical carcinoma is a secondary infection of the ascending urinary tract. (6) The diagnosis is always difficult, especially after the onset of complications.

INCOMPLETE AND COMPLETE HYPOTHYROIDCEA OR MYXÆDEMA.

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DEFICIENT secretion of the thyroid, according to the degree of subactivity and age of the subject, may cause at least three distinct clinical entities. Deficiency of secretion varying in amount from nearly normal to virtually none may produce mild nervous symptoms of a vague nature, or various grades of *myxædema*, *idioey*, or *cretinism*: just as an excess of secretion, or hyperthyroidceæ varying in degree produces either tachycardia or profound intoxication with severe derangement of the whole body, or even death. Somewhere, then, between the normal secretion and almost total cessation of secretion, producing marked and complete myxædema, there is a condition of subsecretion which brings about what is known in medical parlance as incomplete hypothyroidceæ. or "*myxædeme fruste*." Cases of this nature are described in detail by Murray,¹ Hertoghe,² Ewald,³ Richardson,⁴ Moffitt,⁵ and Howard,⁶ and they

¹ British Med. Jour., 1898; Twentieth Century Practice of Medicine.

² Nouv. Iconographe de la Saltpêtrière, 1899.

³ Die Deutsche Klinik.

⁴ The Thyroid and Parathyroid Glands, 1905.

⁵ Jour. Amer. Med. Assoc., vol. xlv, No. 12.

Ib'd., vol. xlviii, Nos. 14 and 16.

have been recognized as belonging to a definite disease group, because they do not tend to progress into a condition of complete myxœdema.

This disease has many things in common with the complete form. It is more frequent in women and among those in the fourth and fifth decade, especially in those who have borne many children, or it may not occur spontaneously, and follow partial thyroidectomy. There is always some structural change in the thyroid as in complete myxœdema, and there can be no doubt as to the causal relationship between thyroid fibrosis and atrophy, and hypothyroidœa.

The symptom complex is as follows: The heart is weak and often dilated. The skin is dry and scaly, and there are curious but typical pads of fat above the clavicle. Very often there are violent joint pains, paresthesias and neuralgias. Associated with these there is a marked asthenia, subnormal temperature, great dyspnœa, and a characteristic *giving way of the knees*. There may or may not be profuse hemorrhages, either spontaneous or traumatic. In short the patient has an incomplete myxœdema without any marked myxœdematous infiltration of the skin. Given a patient with severe unaccountable dyspnœa, rheumatic pains, and sensation of being cold at all times, a physician should suspect the disease at once. It is evident that the disease is due to a subactivity, or inefficiency of the thyroid gland: (1) because there is an atrophy or fibrosis of the gland; (2) partial thyroidectomy causes it; and (3) it is relieved by the administration of thyroid extract.

In four cases described by Murray, the ages of the patients ranged from forty-four to sixty years. In Moffitt's cases, six in all, the ages at which the disease developed were from thirty-five to sixty-five years. The disease thus is one of middle life. There is sometimes a history of other thyroid disease in the family.

In general the incomplete form bears resemblance to complete myxœdema, but the symptoms are not so profound, nor are there the disfiguring spade-like hands, nor the gross, solid œdema so characteristic of the true form.

In examining a patient with hypothyroidœa the physician is often struck with the disproportion between the cardiac and the pulmonary lesions, or lack of them, and the dyspnœa which is bitterly complained of, and which is often manifest.

In most cases the heart is dilated to some degree; there is, too, a diminution in strength of the first sound. Sometimes there are faint or even marked murmurs depending upon the dilatation.

The cardiac area to the left of the sternum is generally enlarged, the impulse weak, and the pulse may be slow and feeble, or it may be rapid and weak. In the case herewith reported the pulse is never below 72 and is sometimes from 110 to 120. One of Murray's patients had a pulse of 80 to 104. Moffitt speaks of a rapid pulse in his cases. Pseudo-angina may be present and with the other neuralgias there may be anginoid pains under the left breast.

The nervous symptoms with the general asthenia are marked and distressing, the giving way of the knees is complained of very much, the patient is tired and disinclined to work. An occipital neuralgia is as often present as frontal headache. Backache, from which the patient suffers greatly, renders her nights sleepless and miserable. Indeed, the patient frequently describes the pain as being so severe that she feels as if her back was being wrenched asunder. The muscles are stiff and the joints painful early in the morning, but generally these symptoms disappear during the day. As in myxœdema the patient feels cold, and is cold, though to the examiner the skin may feel hot and dry. The mental symptoms are sometimes marked. Hallucinations of sight and hearing are common, sound of running water may apparently be heard, visions of cats, dogs, mice, and rats, or of people passing, often occur, even in bright rooms. Murray describes a case in which a marked hallucination was present; it was that of a man knocking a woman down stairs.

The facial expression is one of "sorrowful fatigue." The eyebrows are arched and the forehead wrinkled. Tinnitus aurium also annoys the patient. Murray speaks of his cases as "early thyroid fibrosis" and the thyroid is generally shrunken, hard, and difficult to palpate. The isthmus may have shrivelled up to a thin band. The skin is dry, harsh, and scaly. On removing the stockings a cloud of fine scales is often cast from them. The hair is brittle, dry, and falls out from the scalp, eyebrows, and axillæ. The hair, too, is frequently prematurely gray and white. Subconjunctival fat is yellow. Murray says that bright yellow fat is characteristic of myxœdematous cases and that thyroidectomized monkeys have vivid yellow fat. Above the clavicles are curious pads of fat which are diagnostic, and are almost always present, as in complete myxœdema. There, too, may be rolls or pads of fat above the dorsal vertebræ and over the manubrium. There also may be isolated patches of solid œdema on the abdomen.

The digestive organs are affected in several ways. In common with many asthenic diseases, hypochlorhydria is often present. In a case here described, hyperchlorhydria was a prominent symptom. The appetite is poor, there is always an obstinate constipation and frequently fecal impaction. The liver is enlarged. Transitory glycosuria sometimes occurs. The kidneys are generally sound, but the urine is scanty and high colored. Casts and albumin may appear; hematuria occurs but rarely. The respiratory apparatus is generally unaffected. The lungs may become emphysematous in elderly women. There is often during menstruation a marked huskiness of the voice which is most characteristic. Cramps or cricks of the larynx, probably neuralgic, annoy the patient, and the mucous membrane of the throat and nose becomes thickened.

Spontaneous hemorrhages may occur from any mucous membrane;

menstruation may be scanty or excessive; alarming hemorrhages sometimes occur and if the patient is pregnant, postpartum hemorrhages must be guarded against. Anemia is common in all cases of incomplete myxoedema, just as it is present in every complete form. There is always a diminution of the red cells and the hemoglobin. In both the complete and incomplete cases herein reported, changes in the morphology of the reds were striking; normoblasts, stippled cells, microcytes, and macrocytes were found. It is hard to correlate the many diverse and bewildering symptoms that occur in this protean disease, except through the fact that the *nutrition* of the nervous system, the muscles, and skin is seriously impaired. All of the symptoms depend on insufficient secretion of the thyroid gland, or of certain elements of the secretion. And it may be found that in this incomplete form one or two ingredients of the juice are lacking. The same elements that are of cardinal importance to the nutrition of the skin may not be quite so relatively deficient as those elements that have to do with the nutrition of the brain or peripheral nerves.

When we consider the numerous and highly different elements that constitute the blood plasma, the functions of which are to neutralize poisons, prevent infection, dissolve cells, and aid in the coagulation of the blood, etc., it is not hard to conceive that the growth and nutrition of the body, or that of the skin, or of the brain, depend upon just as diverse elements in the thyroid secretion as complements, hemolysins, and fibrinogens which are found in the blood plasma. If there is singleness of function of the thyroid secretion, it may be that it acts in the same way that Ehrlich's amboceptors act in serving to unite nutritious matters of the blood to cells.

Mrs. K. has the following history of invalidism for sixteen years: She is fifty-five years of age and comes of a healthy family. Her mother is still living, but her father died of sclerosis of the spinal cord. At the age of thirteen she began to menstruate, and continued to do so until she was fifty-two years of age. She has given birth to four large healthy children, and has had the usual diseases of children, pneumonia, and one very bad postpartum hemorrhage. She consulted me for her general condition, which was that of marked asthenia, with a remarkable array of symptoms apparently totally unrelated. She is not corpulent, weighing 145 pounds; is of medium height and build; is active and quick in her movements, and has no disfiguring myxoedema, in fact she is a handsome matron, and except for the anemia, is well nourished. For years she has been afflicted with an occipital neuralgia, which has been at times intractable and violent; she has also suffered from dyspnoea, joint pains, marked myalgias, giving way of the knees, and profuse uterine hemorrhages. A careful physical examination showed a weak musculature, and a harsh dry skin that scaled very easily. Her stockings

frequently contained quantities of fine, powdery scales. Above the clavicles oval pads were found, and over the abdomen there was a layer of myxœdematous infiltration. The upper eyelids were swollen and puffy. At times her feet have been œdematous. Her heart dulness was somewhat enlarged to the left, but no murmurs were found. The apex beat was weak and diffuse. The heart was evidently dilated at times.

On account of the dyspnœa, hemorrhages, and weakness of the knees, she had been compelled to remain in bed for many months out of the year. The hemorrhages lasted for three or four weeks, and were difficult to control. An examination by an expert gynecologist revealed a small polyp, the removal of which did not modify the hemorrhages. The uterus otherwise was normal. Her hair turned gray when she was thirty-five years of age, and was brittle and dry, but did not come out easily. Her pharynx and uvula were slightly swollen, and her tongue was indented. At times she has suffered from cramp of the tongue and larynx, and her voice became husky during menstruation. Her pulse was weak and rapid at times, but under thyroid extract its rate diminished. Her vessels were pliable and not atheromatous. She had had a glycosuria of short duration. Her kidneys have always been healthy, although casts were found occasionally. The specific gravity of her urine was 1030, and the amount 40 ounces in twenty-four hours.

It is said that in 20 per cent. of cases of myxœdema, casts and albumin appear in the urine. They often confuse the examiner and he is led to think that the case is nephritis. She has always had a hyperacid stomach, with some tendency to flatulency, and has been constipated, and suffered from impaction at times. Her nervous symptoms were most characteristic; she had, besides the joint pains, backache, and occipital neuralgia, hyperesthesia of the skin of the neck and supraclavicular pads, twitching eyelids, and a slight tremor of the hands, and at night would sometimes tremble for a long time without cause. An examination of her reflexes showed them to be normal. At one time it was thought she had angina pectoris, so intense was the pain in her chest under the left breast. Her joints were so painful that she could not move them, and when she arose in the morning she could hardly step on the floor on account of the pain in her soles. Her rather defective memory was the only sign of any mental involvement. She has never been mentally depressed. At times tinnitus has annoyed her. She sometimes thought she saw people in her room when it was empty. Her nights have been wretched on account of backache, tremblings in her limbs, and aching of the joints, especially of the spine. Her blood showed a moderate anemia: Hemoglobin, 76 per cent.; red cells, 3,268,000; blood index, 1.06; whites not counted. Differential count: Polymorphonuclears, 39 per cent.; lymphocytes, 59.2 per cent.; eosinophiles and myelocytes, 1.8 per cent. Nor-

moblasts, poikilocytes, macrocytes, and microcytes were seen. Numerous red cells exhibiting basophilic degeneration also were found.

Under thyroid extract many of the symptoms were relieved. She cannot tolerate much of any drug. More than 8 grains a day of the extract causes thyroidismus, which is indicated by fever and increased tremor. Under thyroid extract treatment she lost ten pounds in six weeks, but she has taken it at intervals during a year with much benefit. Her dyspnœa is less; her headaches fewer and farther apart, the tremor is gone, and her condition is generally improved. Cold East winds are trying to her still, causing joint pains and occipital neuralgia occasionally. Arsenic, iron, and strychnine have benefited her, as has general massage, which she has taken for years. The constipation was relieved by sodium glycocholate.

COMPLETE MYXŒDEMA. In contrast to the foregoing case the following one of *complete myxœdema* presents not very many differences in the subjective symptomatology, and is a typical case, especially as to the solid œdema.

Mrs. S., a large Englishwoman, aged forty-five years, mother of thirteen children, and of excellent family history, consulted me repeatedly for dyspnœa, and great weakness in the knees. I have attended her for ten years, and delivered her of her last two children. She was always healthy until the birth of her last child five years ago (when forty years of age) when she began to complain of shortness of breath and giving way of her knees. Associated with these two symptoms was a great sensitiveness to cold, even in hot summer weather. After treating her unavailingly for her dyspnœa and weakness, I discovered that she was becoming larger every month. Careful examination showed that she had become myxœmatous. Her hands were very clumsy, her legs and arms and trunk œdematous, but they did not pit on pressure. I could not palpate her thyroid. Her lungs were normal, except for a slight emphysema. Her cardiac dulness had greatly increased and a faint mitral systolic murmur appeared, her pulse was weak and flabby, her dyspnœa was so great that she could hardly walk. Her weight increased from 180 to 205 pounds. Supraclavicular swellings also developed and transitory swellings in the neck appeared over the angle of the jaw. The mucous membranes of the throat and nose became swollen. Her voice was husky, and she had scanning speech. The tongue was swollen and flabby. She complained of constant headache, and was dull and listless. She also had tinnitus aurium. Her expression was one of stupid listlessness, her forehead was wrinkled, and she looked weary and oppressed. Joint pains affected her greatly, as did a constant backache. She could not sleep and she suffered much from cold, and upon putting her hands in cold water they would swell and turn blue and were very painful. Her upper incisor teeth were stained black. This is very characteristic of myxœdema.

The urine was normal in every respect, except that it was highly colored, and of high specific gravity. She was anemic: a careful blood count on two occasions showed that she had red cells, 3,344,000; hemoglobin, 75 per cent.; white cells, 13,200 and 6900 on two occasions. A differential count showed: Polymorphonuclears, 46 per cent.; mononuclears, 52 per cent.; myelocytes and eosinophiles, 2 per cent. Stippled red cells were seen in small numbers, as were nucleated red cells. She never had any hallucinations, or severe hemorrhages; nor had she much neuralgia, suffering but twice from trifacial neuralgia.

In September, 1906, she developed a severe bronchitis, and suffered much from dyspnoea, which at that time was due to her dilated weak heart. Dr. M. Howard Fussell saw her in consultation at that time and confirmed the diagnosis of myxoedema. Thyroid extract in daily doses of 15 to 30 grains was administered for a year with very much benefit. Her dyspnoea and nervous symptoms were greatly ameliorated and she was able to move about with great comfort, but was still very myxomatous. Strophanthus and strychnine helped her a great deal. After eighteen months' treatment she became a ruddy, buxom matron again and was bright and intelligent.

The interesting features of this case are the presence of a tremor, absence of hemorrhages, the effect of the cold water on her arms, and great heart weakness.

In both cases the finding of nucleated and degenerated red cells in the blood is of interest, especially when the hemoglobin percentage was not very low. Both cases were in women who had borne numerous children, and both developed the disease when between thirty-five and forty-five years of age. Myxoedema seems to be one of the penalties of childbearing. The weak knees and heart were very prominent symptoms in both cases as was the tremor.

A METHOD OF OBTAINING CULTURES FROM HUMAN BLOOD.

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IN making cultures from the living human blood, Lenhartz and Schottmüller advised the mixing of freshly drawn blood with liquified fluid agar (at 45° C.) and the incubation of the culture at 37° C. The method has been employed by them to a large extent and numerous positive blood cultures have been obtained—in sepsis, typhoid fever, pneumonia, and other diseases associated with bacterial infection of the blood. The blood is usually drawn from a

vein by means of a Luer's blood syringe, which can easily be sterilized and usually fills by the mere action of the blood pressure. Instead of using the syringe, another simple and less expensive technique may be resorted to which can easily be improvised and gives quite satisfactory results.

A common test tube, such as is used for bacteriological work, is drawn out and bent in the flame of the Bunsen burner until it assumes the shape shown in Fig. 1. It may be drawn out to a sharp point which is sealed in the flame, the open end being closed by means of a plug of absorbent cotton. The tube may contain about 20 c.c. It is sterilized, and immediately before using the sharp point is broken with a file so as to obtain an oval opening wide enough to allow the blood to enter without difficulty. The blood is drawn by means of a wide, sharp-pointed infusion needle as is used for hypodermoclysis, the needle being pushed through the previously well cleansed and disinfected skin into the median cephalic or basilic vein. The pressure within the vein is artificially increased by turning a towel round



FIG. 1.—Test tube drawn out and bent for blood culture work.

the arm and thus compressing the brachial vein. The blood readily enters the infusion needle, which should have been previously attached to the test tube by means of a short piece of well boiled and sterilized rubber tubing (Fig. 2) and ascends slowly within about one-half to one minute in the interior of the sterile tube. About 10 to 15 c.c. of blood may be drawn in this way. When the blood level within the tube is about one-half inch below the cotton plug the towel compressing the brachial vein should be released and the needle withdrawn. The thumb of the right hand pressing against the open mouth of the tube above the sterile cotton filter retains the blood by air pressure. The rubber attachment should be removed and the blood immediately distributed into five or six tubes containing liquefied plain agar or glycerin-agar of a temperature of 44° C., and thoroughly mixed with it by rapidly twirling the tubes between the hands. The mixture then should be put into Petri dishes before the agar solidifies, and the blood culture transferred to the thermostat as quickly as possible.

In this way I examined the blood of six patients in the King's County Hospital. In 3 cases the blood-agar plates remained sterile, in the rest I obtained a positive bacteriological finding. The first of these cases was a grave sepsis caused by a neglected phlegmon of the right leg. The patient was received in a hopeless state, running a high continuous fever, markedly jaundiced, and died after a few days. The blood culture which was taken two days before death revealed in three agar-plates (about 7 c.c. of blood) the presence of streptococci, which could be seen as pure colonies, in number about 50, after thirty-six hours' incubation. The colonies appeared as small blackish spots within the blood-agar; they showed whet-stone form, and were characterized by a colorless halo about 2 mm. in diameter, within the limits of which the hemoglobin of the red blood cells had disappeared.

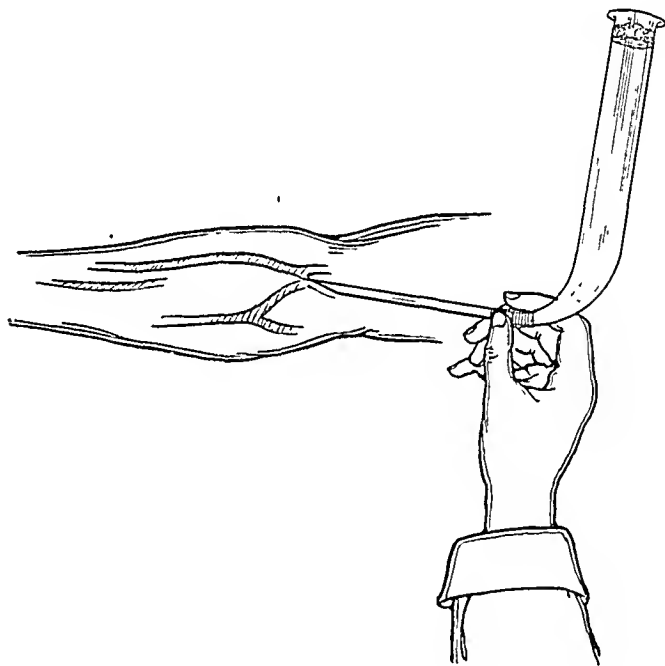


FIG. 2.—Withdrawing the blood for cultural purposes.

The second case was one of puerperal sepsis. The patient was received in the hospital running a continuous high temperature, about 104° F. When the blood culture was made the skin of the breast, legs, and arms showed an extensive erythematous rash, in appearance very much reminding one of scarlatina. The rash disappeared after about twenty hours. The culture showed, after twenty-four hours incubation, numerous colonies of streptococci, and colonies of another kind, appearing as blackish spots within the agar, which, rapidly extending to the surface, spread as yellowish well-circumscribed, moist, and shining round colonies (*Staphylococcus pyogenes aureus*). Twenty-four hours after the culture had been taken, the patient died.

The third case was one of typhoid fever, toward the end of the second week. The temperature was between 103 and 104° F. The blood culture showed, in 10 c.c. of blood, 102 pure colonies of typhoid bacilli. The typhoid colonies appeared as blackish spots and points, visible after twenty-four hours incubation. Within the next twenty-four hours part of them reached the surface where they spread as a well-circumscribed shining growth, showing a peculiar grayish (mouse-gray) color.

The pneumococcus has been found by Lenhartz in grave cases of pneumonia in 20 per cent. of the cases. As to the appearance of its growth it may only be mentioned here that the macroscopic appearance of the colonies in blood-agar plates closely resembles that of the streptococcus varieties, but the halo of decoloration surrounding the single colonies which appear as black wheat-stone shaped spots of about 0.5 mm. in length is not clear as in the case of the streptococcus, but shows a distinct greenish hue.

OBSERVATIONS UPON CERTAIN BLOOD-PRESSURE-LOWERING REFLEXES THAT ARISE FROM IRRITATION OF THE INFLAMED PLEURA.

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THORACENTESIS and all operative procedures inside the thoracic cavity where inflammation exists may be accompanied or followed by disturbances of circulation. These occur even when such complications as pulmonary oedema, accidental hemorrhage, and pneumothorax can be definitely excluded. As a rule these disturbances are trivial and consist of lowering of arterial tension accompanied by faintness. Occasionally, however, the symptoms are serious. Without warning the patient becomes dyspnoic and cyanotic, and the pulse is thready, with a tension below the safety point. Unconsciousness and death may supervene in a few minutes or in a few hours.

The cause of death in these cases is usually not discovered by the pathologist. Rarely emboli or thrombi are found in the heart or pulmonary arteries and even more rarely in the cerebral arteries

(Rosenbach). After excluding such exceptional conditions there still remains a considerable number of cases of sudden death in which *no anatomical lesion can be found postmortem to explain the collapse*.

Rosenbach¹ considers that the chief factors in producing death in these obscure cases are anemia of the heart or brain, sudden heart-failure, or a reflex inhibition of the respiratory and cardiac centres. Russell² believes that the pulmonary fibers of the vagus nerve, made sensitive by inflammation, carry impulses to the medulla. The impulses originate, he thinks, in the alveoli and not in the pleura.

In a series of recent observations by one of us³ upon the blood pressure in aspirating pleural effusions, it was concluded that the *rapidity of withdrawal*, the removal of a *large amount* of fluid, the presence of a *long-standing effusion* and of *senile changes* in the heart and bloodvessels, were the chief factors in bringing about a marked fall of arterial blood pressure with unfavorable symptoms. All these, however, are contributing causes only and fail to explain the mechanism of the phenomena.

The following experiments were made with the purpose of finding out if possible the nature of this mechanism:

GROUP I.—*Aspiration of Oil from the Normal Pleural Cavity*. All the dogs under this group were injected in one pleural cavity with sterile cotton-seed oil, which, unlike watery solutions, is not absorbed by the pleural membrane. The fluid was allowed to flow in until the first signs of dyspnoea developed. Readings of the blood pressure were taken before, during, and after aspiration.

EXPERIMENT 1. 700 c.c. cotton-seed oil injected into left pleural cavity of large dog. 500 c.c. withdrawn in the period of five minutes:

Initial blood pressure	130 mm. Hg.
After injection of 700 c.c. of oil	140 "
Immediately after aspiration of 500 c.c.	115 "
Final blood pressure ten minutes after aspiration	120 "

EXPERIMENT 2. Medium-sized dog:

Initial blood pressure	132 mm. Hg.
After injection of 500 c.c. of oil in left pleural cavity	138 "
After aspiration of 400 c.c.	134 "
Final blood pressure eight minutes later	130 "

EXPERIMENT 3. Large dog:

Initial blood pressure	128 mm. Hg.
After injection of 750 c.c. of oil in right pleural cavity	148 "
After aspiration of 550 c.c.	140 "
Final blood pressure five minutes later	125 "

¹ Nothnagel's Encyclopedia of Medicine, 1903.

² St. Thomas' Hospital Reports, 1899, vol. xxviii.

³ Capps, Jour. Amer. Med. Assoc., January 5, 1907.

EXPERIMENT 4. Rather small dog:

Two days after injection of 450 c.c. sterile oil in right pleural cavity	100 mm. Hg.
After rapid aspiration of 350 c.c.	120 "
Final blood pressure	100 "
No pleurisy found postmortem.	

EXPERIMENT 5. Medium-sized dog:

Initial blood pressure	70 mm. Hg.
After injection of 600 c.c. of oil in right pleural cavity	80 "
After aspiration of 450 c.c.	70 "
Final blood pressure ten minutes later	70 "

EXPERIMENT 6. Dog of large size:

Initial blood pressure	100 mm. Hg.
After injection of 600 c.c. of oil in left pleural cavity	110 "
After aspiration of 350 c.c.	95 "
Final blood pressure ten minutes later	97 "

Discussion. The average rise in blood pressure in these six cases produced by injecting the oil was about 12 mm. Hg. The average fall in pressure as a result of aspiration was 11 mm. Hg. The rise in pressure accompanying the introduction of fluid may be attributed to the diminution of lung space and to pressure exerted by the weight of the fluid on the lungs, the heart, and the neighboring vessels. The fall in pressure following aspiration may be referred to the restoration of physiological conditions. There was no evidence of any reflex disturbance of circulation during aspiration, such as transitory falls in pressure or changes in the pulse rate.

GROUP II.—*Aspiration of Exudates in Artificial Pleurisy.* The pleurisy was created by injecting from 10 to 300 c.c. of cotton-seed oil contaminated with bacteria in one pleural cavity of a dog. At the end of twenty-four to forty-eight hours a bilateral pleurisy had developed, with a thick pleural exudate and a large amount of free fluid on the injected side; on the opposite side, a thinner pleural exudate and very little free fluid. The fluid was aspirated with a water pump as rapidly as possible.

EXPERIMENT 7. Bilateral pleurisy in a dog which had been injected forty-eight hours before with 10 c.c. of dirty oil in the right chest:

Blood pressure before aspiration	130 mm. Hg.
After aspiration of 150 c.c. of oil and exudate	110 "
Ten minutes later	115 "

EXPERIMENT 8. Dog with marked right pleurisy twenty-four hours after injection of 200 c.c. of oil in right side; left pleura congested:

Blood pressure before aspiration	90 mm. Hg.
After aspiration of 150 c.c.	70 "
Six minutes later	74 "

EXPERIMENT 9. Dog injected forty-eight hours previously in right pleural cavity with 300 c.c. of dirty oil. Right pleurisy moderate, left slight:

Initial blood pressure	. . . . .	110 mm. Hg.
After aspiration of 200 c.c.	. . . . .	110 "
Five minutes later	. . . . .	110 "

EXPERIMENT 10. Bilateral pleurisy in dog injected in left side forty-eight hours before with 225 c.c. of oil:

Initial blood pressure	. . . . .	130 mm. Hg.
After aspiration of 150 c.c.	. . . . .	130 "
Six minutes later	. . . . .	130 "

EXPERIMENT 11. Bilateral pleurisy forty-eight hours after introduction of 200 c.c. of oil in right pleural cavity:

Initial blood pressure	. . . . .	110 mm. Hg.
After aspiration of 150 c.c.	. . . . .	100 "
Eight minutes later	. . . . .	105 "

EXPERIMENT 12. Bilateral pleurisy forty-eight hours after injection of 200 c.c. of oil:

Initial blood pressure	. . . . .	120 mm. Hg.
After aspiration of 100 c.c.	. . . . .	100 "
Five minutes later	. . . . .	105 "

EXPERIMENT 13. Bilateral pleurisy forty-eight hours after introduction of 200 c.c. of oil into right cavity:

Initial blood pressure	. . . . .	140 mm. Hg.
After rapid aspiration of 100 c.c.	. . . . .	30 "
Three minutes later	. . . . .	Death.

During the process of aspiration in this experiment the respiration slowed and finally ceased altogether, although the ether was withdrawn.

Discussion. It should be noted that the average amount of exudate withdrawn in this group was about 150 c.c., while the average quantity in Group I was about 500 c.c. We should expect less of a fall in pressure, therefore, in Group II from purely pressure effects. As a matter of fact, the results were about the same in the two groups, which would indicate that aspiration of a small quantity of fluid from an inflamed pleural cavity may produce as much lowering of tension as a much larger quantity of fluid from a normal cavity. Transitory changes in pressure were common during these experiments, and especially in the last one it was observed that the movement of the trocar on the pleura sometimes caused a marked fall in blood pressure, even when the amount of fluid aspirated was small. We were thereby led to investigate the effect produced on blood pressure by irritation of the pleura, healthy and inflamed, independently of aspiration.

GROUP III. *Irritation of Healthy Pleura.* The procedure in these experiments was as follows:

The dog was etherized and laid on the operating table. The trachea was opened and a cannula inserted which connected with a flask of ether. By means of a T-glass cannula in this connecting tube a smaller tube was attached that carried the air waves to a recording

tambour. The blood-pressure tracings were made by means of a mercury manometer connected with the carotid artery.

A trocar was inserted in the mid- or post-axillary line, fifth or sixth interspace, and the sharp point withdrawn. A scratching movement of the blunt trocar was made, then a similar movement with the sharp point. Formalin (3 to 5 drops) was then blown upon the visceral surface of the pleura by inserting a long glass tube through the trocar, precautions being taken to avoid entrance of air. These experiments were then repeated on the opposite side. In six of the nine dogs in the group the chest was laid open by cutting through the midsternal line and artificial respiration was maintained. We were then enabled to try chemical, thermal, and electrical forms of irritation at various parts of both the parietal and visceral pleura, the pericardium, and the nerve branches themselves.

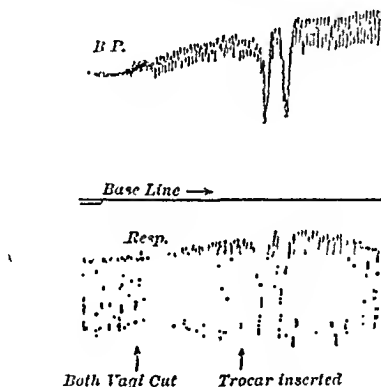


FIG. 1.—Effect of forcing a trocar through the chest wall into the pleural cavity of a normal dog. Note the transitory drops in blood pressure and disturbance of respirations. Section of both vagus nerves in the neck does not alter the reaction. The fall in pressure is greatest at the moment the *parietal* pleura is pierced.

As the results were so nearly uniform, Experiments 13 to 22 may be briefly summarized. Mechanical irritation of the visceral pleura with a dull instrument was always negative; with a sharp point there was either very slight or no reaction. Only once did chemical irritation produce a reaction, and that was slight. Formalin was nearly always employed. Bromine and ammonia, which were occasionally used, also had no effect upon blood pressure. Thermal irritation was tested by means of a hot iron or a piece of ice held in the forceps. All tests were negative. Electrical stimulation with the induced current did not affect blood pressure unless a strong current was applied to the roots of the lung, in which location inhibitory effects on the heart were elicited.

Quite constantly a transitory fall in pressure and a checking of respiration accompanied the penetration of the perietal pleura with the trocar (Fig. 1).

It should be added that either mechanical or electrical stimulation of the pericardium is likely to set up a cardio-inhibitory reflex when the membrane lies upon the heart. If the pericardium is separated, however, from the heart muscle, no effect follows such irritation. The reflex, therefore, is a stimulation of the cardiac nerves transmitted through the pericardium. Any violence to the heart by sudden displacement or accidental contact of the trocar may give rise to such a reflex, which, fortunately, is transitory and does not cause a lasting change in blood pressure.

These results confirm the excellent series of observations by Brodie and Russell⁴ on the healthy lungs of dogs. They found the pulmonary fibers at the root of the lung and in the bronchial tubes and alveoli would respond to electrical stimulation with a more powerful cardio-inhibitory action than any other branches of the vagus nerve. In addition to this effect on the heart they found that strong excitation of the pulmonary fibers, as by the inhalation of formalin, acted also on the respiratory and vasomotor centres. Since they found no effect on blood pressure from stimulation of the healthy pleural membrane except where the nerves enter the lung, Russell assumed that no reflexes arise from the diseased pleura.

Such an assumption, however, is not justified, because an inflamed nerve may be sensitive to irritants to which the healthy nerve is not sensitive, and consequently the inflamed nerve may cause reflexes which the healthy nerve does not induce. A reflex of this type is pathological.

An illustration of this principle is afforded by the recent experiments of Buerger and Churchman.⁵ They found that electrical excitation of the coeliac plexus in healthy animals produced no bad results. Similar excitation of the plexus after a peritonitis had been produced by injection of turpentine caused collapse and death, either during or after the operation. It was assumed therefore that the inflammation rendered the nerves abnormally susceptible to the conduction of reflexes causing vasodilatation.

Bearing in mind these possibilities we tried various forms of stimulation of the pleura in a series of animals in which varying degrees of pleuritis had been produced by different forms of irritants.

GROUP IV.—*Irritation of Inflamed Pleura.* An artificial pleurisy was set up by two methods. The first consisted of injecting a few cubic centimeters of turpentine mixed with cotton-seed oil. At the end of six hours flakes of fibrin were visible over the congested pleural surface; in twenty-four hours there was a fairly thick membrane and an accumulation of fluid exudate. The opposite side was usually not involved.

The second method was carried out by injecting in the chest 10 to

⁴ Jour. Phys., 1900, vol. xxvi, p. 92.

⁵ Mitteil. d. Grenzgeb. d. Med. u. Chir., 1906, vol. xvi.

200 c.c. of cotton-seed oil contaminated with bacteria. In twenty-four hours the pleural surface was covered with a fibrinous film and a few flakes were often found on the opposite side. After forty-eight hours the inoculated side presented a dense, fibrinous exudate with fluid accumulation, while the opposite pleura was overlaid by a thin, fibrinous exudate, accompanied by a variable amount of free fluid.

Since the chemically produced pleuritis develops more quickly, animals so treated were employed from six to twenty-four hours after injection. The animals inoculated with the more slowly developing bacterial injection were subjected to experiment twenty-four to seventy-two hours after the injection.

It seemed desirable to test the pleura under various degrees and varieties of inflammation as well as to compare in the same animal the effect of irritation of the highly inflamed pleura of one side with the slightly inflamed pleura of the other side.

(A) *Chemical Pleuritis from Injection of Turpentine.*

EXPERIMENT 23. A dog had been injected on the left side twenty-four hours previously with 3 c.c. of turpentine mixed with 9 c.c. of sterile oil. Animal appeared languid. Ether anesthesia. A mercury manometer was connected with the carotid artery and the respiratory tambour with the breathing cannula, which was inserted in the trachea. After the ether was evenly regulated, a trocar was forced into the right chest in the fifth interspace in the midaxillary line, and the sharp point retracted. The visceral pleura was then scratched with the blunt end of the trocar, with no change in blood pressure. The sharp point also caused no change in pressure when scraped along the visceral or parietal pleura. Three drops of formalin blown through the trocar caused no change in blood pressure, although respirations were slightly slowed. No effect was observed from the trocar irritation of the left visceral and parietal pleura, but the introduction of 2 drops of formalin caused a sudden slowing of the heart with long strokes of the pen (cardio-inhibitory or "vagal" type), with simultaneous slowing of respiration. The effect lasted for a little over a minute (Fig. 2). The chest was then opened by bone-cutting forceps in the median line, and the thoracic viscera exposed. Respirations were maintained by an air pump. This latter procedure lowered the blood pressure from 100 mm. to 70 mm., at which level the tracing remained steady. Mechanical irritation of left and right parietal and visceral pleura with blunt and sharp point had no effect on blood pressure. Scratching the pericardium "in situ" set up long drops of "vagal" type, but when the sac was held away from the heart, the irritation had no effect. Laceration of the lung tissue by squeezing in forceps was

negative. Electrical irritation (faradic) of left and right visceral and parietal pleuræ was negative. Stimulation of pericardium "in situ" gave "vagal" type of curves identical with those following direct stimulation of the heart muscle, but stimulation of the free pericardium was negative. Chemical irritation of both visceral and parietal pleuræ had no influence on the pressure curve. Thermal irritation by hot iron and ice of left and right parietal and visceral pleuræ did not alter blood pressure. Briefly stated, the only reflex obtained was through irritation of the left pleura by formalin, and this reflex was lost after opening the chest. Postmortem a fairly marked exudate in left side, with fibrinous pericarditis, was found. Right pleura was normal.

EXPERIMENT 24. A dog had been injected twenty-four hours previously in left side with turpentine 2 c.c. and oil 10 c.e. Trocar irritation of both left and right visceral pleuræ, negative. Formalin

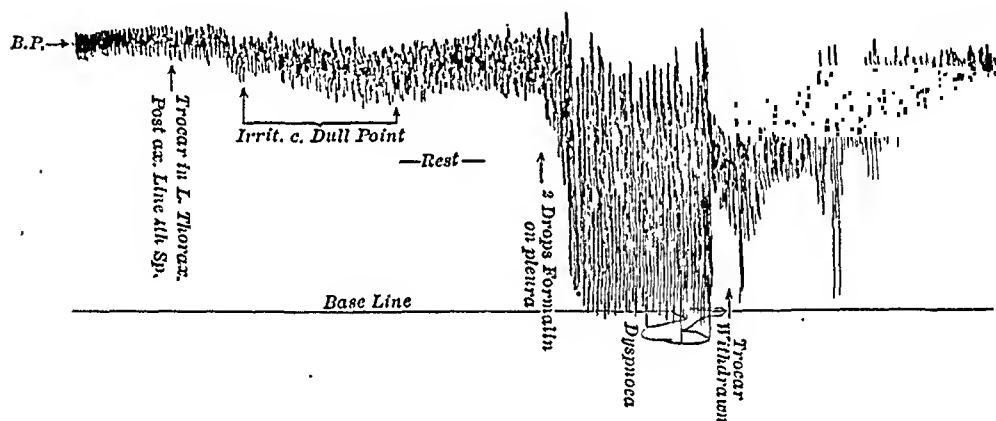


FIG. 2.—*Cardio-inhibitory Reflex.* The upper tracing represents the blood pressure; the base line is below. The inflamed pleura was irritated first with the trocar, then with two drops of formalin. Note the sudden appearance of long and slower strokes after the formalin. Recovery was spontaneous.

2 drops on right visceral pleura caused slowing of respiration and slight fall in blood pressure. The same amount of formalin on left visceral pleura caused slowing and temporary stopping of respiration, with decided fall in blood pressure (20 mm.). Recovery in about one minute. Postmortem: Thin layer of lymph and small amount of purulent exudate on left side; right pleura congested, no exudate.

EXPERIMENT 25. Left side of chest of dog injected eight hours previously with turpentine 4 c.c. and oil 8 c.c. Blood pressure, 160 mm. Hg. Right visceral pleura repeatedly irritated with sharp point of trocar caused slight slowing of respiration, frequent vagal curves, with a slowing of heart and steady fall in blood pressure to 120 mm. Hg. in the course of two minutes. Rapid recovery to 130 mm. when irritation ceased. Trocar irritation of left visceral pleura slowed respiration slightly, but made no appreciable change in blood pressure. Trocar irritation of right visceral pleura was repeated with

fall in blood pressure from 165 to 140 mm. Then both vagi were cut in the neck. The blood pressure fell to 120 mm., then remained steady while respirations were slower. Further irritations of right pleura caused steady fall in blood pressure to 110 mm. with "vagal" strokes. Formalin 4 drops on right visceral pleura negative. Formalin 4 drops on left visceral pleura caused immediately respiratory paralysis and a rapid fall in blood pressure, with death. The cardio-inhibitory curves were set up especially by irritation near root of lungs. Section of vagus nerves failed to destroy entirely the cardio-inhibitory curves or the vasomotor fall. Postmortem: Left pleurisy with thin layer of fibrin and small amount of fluid. Right pleura congested. The abdominal viscera were engorged with blood.

EXPERIMENT 26. Dog was injected six hours before in right chest with turpentine 2 c.c. and oil 6 c.c. Blood pressure, 90 mm. Trocar irritation of left visceral pleura negative. Trocar irritation of right visceral pleura was followed by slight lowering of blood pressure from 90 mm. to 80 mm. and respirations unchanged. Postmortem: Fine fibrinous threads over right pleura. Left pleura normal.

EXPERIMENT 27. Six hours before experiment a small dog was injected in right chest with turpentine 4 c.c. and oil 4 c.c. Blood pressure 100 mm. Trocar irritation of right visceral pleura was negative. Trocar irritation around root of right lung caused the cardio-inhibitory curves. Trocar irritation of left visceral pleura was negative. Formalin 5 drops on left visceral pleura was negative. Formalin 5 drops on right visceral pleura followed by slower and more shallow respirations and by a fall in blood pressure to 76 mm., with long curves. Recovery in about two minutes. Postmortem: Thin pleuritic exudate on right side. Left pleura normal.

EXPERIMENT 28. Dog injected twenty-four hours before in right pleural cavity with turpentine 1 c.c. and oil 6 c.c. Blood pressure, 118 mm. Hg. Trocar irritation of right visceral pleura caused a slight fall in blood pressure. Trocar irritation of left visceral pleura was negative. Formalin 5 drops on right visceral pleura was followed by a gradual rise in pressure from 120 mm. to 134 mm. Formalin 5 drops on left visceral pleura was negative. Postmortem: Right pleuritis with thick fibrinous exudate and free fluid. Left pleura normal.

(B) *Bacterial Pleuritis of Twenty-four Hours or Less After Injection of Contaminated Oil.*

EXPERIMENT 29. Twenty-four hours previously dog received injection in the left chest of 5 c.c. of contaminated oil. Blood pressure, 122 mm. Trocar irritation with sharp and dull point of right visceral pleura was negative. Trocar irritation with dull point of left visceral pleura was negative. Trocar irritation with sharp

point of left visceral pleura caused a rapid fall in blood pressure from 110 mm. to 64 mm., with shallow respirations. Recovery in

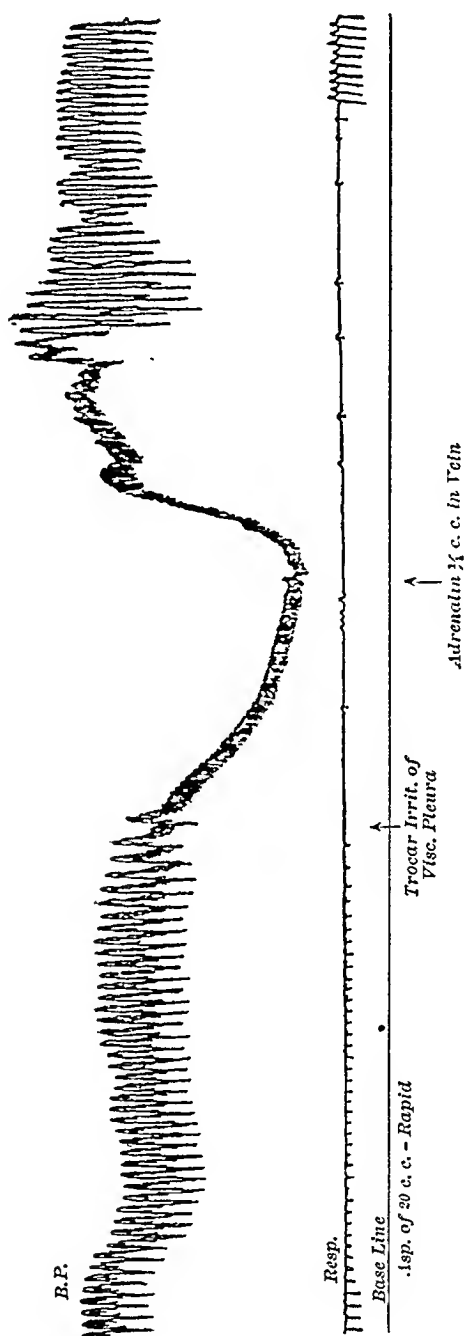


FIG. 3.—*Vasomotor reflex* resulting from scratching the inflamed visceral pleura with a sharp point of the trocar. Respirations ceased simultaneously with the fall in blood pressure. Adrenalin intravenously caused rapid recovery of pressure with gradual return of respirations. Note also the moderate fall in pressure from the rapid withdrawal of fluid.

two minutes to 80 mm. An injection of 0.5 c.c. of adrenalin in the femoral vein was followed at once by a rise in blood pressure to 200 mm. and the animal recovered (Fig. 3.) Formalin drops 5 on

right visceral pleura was negative. Formalin drops 5 on left pleura caused a slight fall in pressure. Postmortem: Right pleura normal. Left visceral pleura showed a fringe of dense fibrin at edge of lobes, smaller flakes over surface and 100 c.c. of fluid. Evidence of trauma from trocar on middle and upper lobes about an inch from right bronchus. No puncture of lung could be detected.

EXPERIMENT 30. Twenty-four hours previously 5 c.c. of contaminated oil had been injected into the left pleural cavity of a small dog. Trocar irritation with dull and sharp point of right visceral pleura, negative. Trocar irritation with dull and sharp point of left visceral pleura, negative. Formalin 3 drops on right visceral pleura, negative. Formalin 3 drops on left visceral pleura caused a slight fall in blood pressure. With the chest laid open and artificial respiration the same tests were repeated with negative results. Formalin injected directly in the lung tissue on both sides, and compression of lung tissue in the forceps, also were without effect on blood pressure. Post-mortem: Left pleurisy with moderate amount of exudate. Right pleura normal.

EXPERIMENT 31. Into the right chest of a dog 10 c.c. of contaminated oil had been introduced twenty-four hours before experiment. With closed chest the visceral pleura was irritated on both sides with trocar and formalin. Except for a slight fall in blood pressure after applying formalin to the left pleura, the result was nil. Post-mortem: Fairly advanced pleurisy on right side. Left pleura normal.

EXPERIMENT 32. To a young dog 8 c.c. of dirty oil was injected in the right thorax twenty-four hours previous to experiment. Scratching the pleural surfaces caused no depression of blood pressure. Application of 5 drops of formalin to the right pleura was followed by a slight fall in blood pressure and slowing of respiration. Both vagi were then cut in the neck. After a period during which the pressure became steady again, 0.5 c.c. of formalin was again applied to the right pleura. Immediately respirations were slowed and the blood pressure fell with long curves from 110 mm. to 40 mm. Recovery was spontaneous. The reflex was not pure vagal, but showed a vasomotor fall as well. Postmortem: Right pleura very congested, but no distinct membrane. Free oil and some purulent exudate in cavity. Left pleura normal.

EXPERIMENT 33. Dog similarly injected in right pleural cavity twenty-four hours before with 200 c.c. of contaminated oil. Rapid aspiration of 150 c.c. of fluid caused a fall in blood pressure from 90 to 70 mm., with gradual recovery to 80 mm. Irritation of right visceral pleura with the trocar produced little change in pressure. Postmortem: Right pleura dotted with fibrin flakes and over 100 c.c. of free fluid present. Left pleura was congested.

(C) *Bacterial Pleuritis Forty-eight Hours or More After Injection of Contaminated Oil.*

EXPERIMENT 34. Dog prepared forty-eight hours before by introduction into left chest of 400 c.c. of dirty olive oil. Blood pressure at beginning of experiment was 150 mm. A trocar was inserted in the fifth space, mid-axillary line of the right pleural cavity. Only 2 or 3 c.c. of fluid had escaped when the blood pressure fell rapidly to 56 mm. and the respirations became shallow. Upon withdrawing the trocar the blood pressure quickly went up to 106 mm. when the trocar was reinserted. Again the pressure fell, soon reaching the abscissa line and terminating in death. The trocar could be felt against the visceral pleural membrane, but the amount of friction was not great. Respirations were shallow and slowed, but continued after the pressure reached zero. Postmortem: Left pleural cavity contained about 300 c.c. of oil and purulent exudate. Pleural surface covered with a thick lymph layer. The right cavity held about 50 c.c. of fluid and a thin layer of fibrinous exudate on the lung, which showed two points where the trocar had scratched the pleura. There was slight ecchymosis, but no rupture of the pleura and no evidence of bleeding in the branchioles or pleural cavity. The abdominal viscera were congested to a high degree.

EXPERIMENT 35. Forty-eight hours previously 450 c.c. of dirty oil had been injected into the left thorax of medium-sized dog. Thoracentesis in right fifth interspace, anterior axillary line. When the sharp point of the trocar was moved over the visceral pleura a steady fall in blood pressure took place and continued until death, which occurred in four minutes. Respirations were shallow and slowed, but continued until blood pressure was nearly zero. Postmortem: Left pleura overlaid with a thick fibrinous layer and in the cavity was about 300 c.c. of oil and pus. The right side contained about 100 c.c. of oil and the pleura was thinly concealed by a lymph layer. Near the root of the lung the pleura was discolored as well as posteriorly by the trocar scratch, but no perforation was present. The bloodvessels of the stomach, intestines, and liver were abnormally congested. Brain normal.

EXPERIMENT 36. For three days 300 c.c. of dirty oil had been present in the left pleural cavity. Irritation of the outer surface of the left visceral pleura with the trocar was negative, but when the trocar scratched the pleura near the root of the lung long "vagal" strokes were produced. Cutting both vagus nerves in the neck seemed to modify these curves, but did not prevent them altogether. Postmortem: Over 300 c.c. of purulent oil in left cavity, with thick plastic layer on pleura. Right pleura also covered with a thick, soft exudate and about 40 c.c. of free fluid in the cavity. No perforation of lung and no hemorrhage was found.

EXPERIMENT 37. Dog had received an injection two days before in left chest of 200 c.c. of dirty oil. A trocar in right pleural cavity in fifth space, anterior axillary line, when moved laterally caused long vertical strokes on the drum, without much influence on the average pressure. On the left side scratching with the trocar was without effect. Postmortem: In the left side of chest was over 200 c.c. of free fluid and a dense pleural membrane. The right lung was covered with a thinner layer of exudate. The heart was displaced to the left. Possibly the trocar touched the pericardium in its movements and thereby set up "vagal" curves.

EXPERIMENT 38. The right thorax of a dog had been injected two days before with 300 c.c. of dirty oil. Trocar irritation of right visceral pleura after withdrawal of 200 c.c. of oil caused practically no change in blood pressure. Trocar irritation of left pleura was followed by a slight fall in pressure. Formalin 2 drops on the left pleura caused great cardio-inhibitory curves, with fall in blood pressure which continued for nearly a minute. Respiration was slowed and labored. Recovery. Postmortem: Right pleura and the pericardium were covered with a thick fibrinous membrane. The left pleura was inflamed and overlaid with a thin, translucent membrane of lymph. The lung tissue puckered where formalin had come into contact with its surface.

EXPERIMENT 39. Dog was injected in the right pleural cavity with 50 c.c. of dirty oil. Mechanical and chemical irritation of pleura were negative. With the chest opened and under artificial respiration, all forms of irritation, mechanical, chemical, thermal, and electrical, were applied to various parts of the pleura with no influence on blood pressure, except over the roots of the lungs, where mechanical and electrical stimulation produced occasional cardio-inhibitory strokes without altering the general level of blood pressure. Postmortem: Right thorax contained about 150 c.c. of turbid oil and over the pleura was a thin, soft exudate. Left lung retracted from pressure of 100 c.c. of fluid and covered with flakes of fibrin. Pericardium concealed by a thick exudate.

EXPERIMENT 40. Dog prepared two days before by introduction of 30 c.c. of contaminated oil into the right pleural cavity. Animal was lively. Stimulation of both pleurae with the trocar caused only the long strokes that occur physiologically from sweeping along the roots of the lung. Formalin had no effect. Postmortem: Very little inflammation was found in the right side of the thorax and only 50 c.c. of oily fluid. The left pleura appeared normal.

EXPERIMENT 41. Dog forty-eight hours before was injected with 10 c.c. of dirty oil in left chest. Trocar irritation of right visceral pleura with dull point caused only a slight lowering of blood pressure from 126 mm. to 120 mm., but upon scratching the surface with the sharp point the pressure fell rapidly until death took place two minutes later. The respirations simultaneously were slowed and

when the pressure reached 50 mm. ceased entirely. Cutting of both vagus nerves in the neck had no apparent effect on the blood pressure (Fig. 4). Postmortem: Pleurisy of high degree on left side, with a thick exudate over the lung. Right pleura much congested, with a few shreds of fibrin on the surface. Slight pericarditis. Evidence of trocar scratches on the right pleura about one inch external to the root of the lung. No perforation of the lung was found.

EXPERIMENT 42. In a dog 10 c.c. of dirty oil had been introduced into the left pleural cavity forty-eight hours previously. Irritation of pleuræ on both sides with sharp and dull point produced no change in blood pressure. Formalin injections on the pleuræ were likewise negative. Formalin 1 c.c. sprayed in trachea and bronchial tubes caused a gradual deep fall in pressure from 120 to 6 mm., with slower and deeper respirations. Spontaneous recovery. Post-

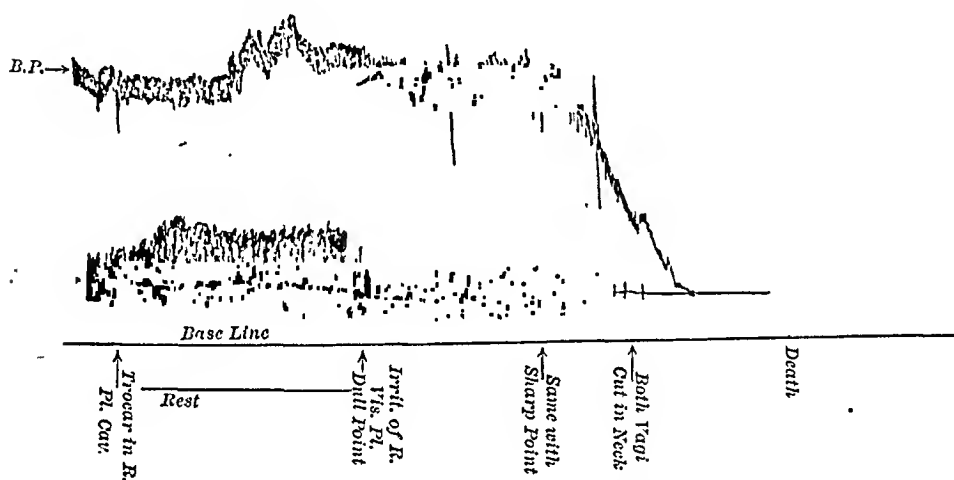


FIG. 4.—Vasomotor reflex following irritation of the visceral pleura with a sharp trocar. At the bottom is the base line, the respirations, and at the top the blood pressure tracing. Note rapid fall of pressure and slowing of respirations until death. Section of both vagi in the neck had no effect on blood pressure. Engorgement of abdominal viscera postmortem.

mortem: Left pleura covered with thick layer of lymph and in the cavity 100 c.c. of fluid. Right pleura red and streaked with a few fibrin shreds.

EXPERIMENT 43. The dog was injected forty-eight hours before with 8 c.c. of dirty oil in the right pleural cavity. Trocar irritation with dull point of right visceral pleura caused a slight fall in pressure, of the left pleura no change except occasional vagal strokes. Formalin 5 drops on left pleura caused a slight fall in pressure with shallow respirations. The sharp point of the trocar moving over the surface of the left visceral pleura caused slowing of respiration, long "vagal" dips, and a steady fall in pressure from 135 mm. to 80 mm. Then both vagi were cut in the neck without marked effect. By discontinuing the irritation of the pleura the pressure gradually recovered to 110 mm. Further irritation caused shallow breathing

and a rapid fall in blood pressure that terminated in death in a minute and a half. Section of the vagi did not prevent the vasomotor reflex. Postmortem: Right pleura covered with thick exudate. Left pleura inflamed and overlaid by a thin film of fibrin. Evidences of trocar scratches and very slight ecchymosis, no perforation. Congestion of abdominal vessels was marked. Brain normal.

EXPERIMENT 44. Dog used forty-eight hours after 10 c.c. of dirty oil was introduced into the right pleural cavity. Trocar irritation of right visceral pleura (dull point) caused a moderate fall in blood pressure, with slowing of breathing. By drawing the blunt point over the region of the sympathetic chain, respiration was slowed, then paralyzed, and the pressure curve showed long vagal sweeps with a rapid fall in tension from 100 mm. to 40 mm. Cutting the left vagus had no effect. When the right vagus was also cut the vagal sweeps

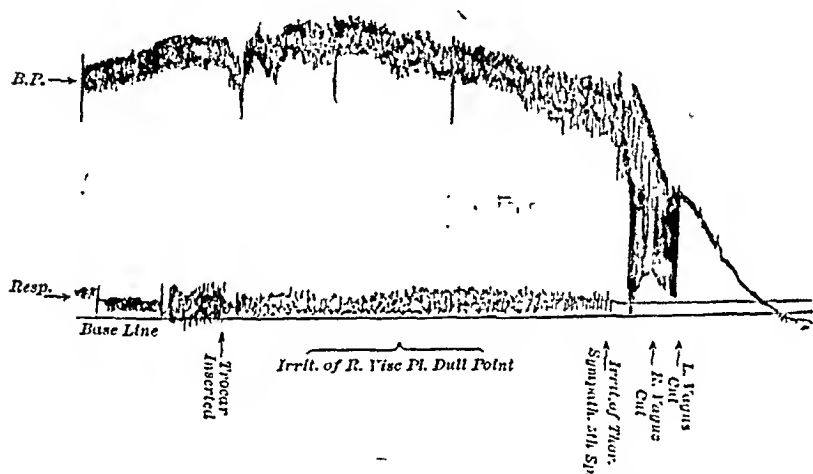


FIG. 5.—Combined cardio-inhibitory and vasomotor reflex from irritation with a trocar of right thoracic sympathetic nerve in a dog with pleurisy. Upper tracing is blood pressure, lower is respirations, and at bottom the base line. Note gradual fall in pressure from irritating visceral pleura with a dull trocar, then rapid fall with long strokes and cessation of respiration when the nerve trunk is irritated. Section of both vagi in the neck eliminated the cardio-inhibitory strokes, but had no influence on the steady vasomotor fall. Death. Note also the transitory fall in pressure and suspension of respiration when the trocar was forced through the chest wall.

disappeared and the pressure fell rapidly until death ensued a minute later; that is, the cardio-inhibitory reflex was abolished by section of both vagi, but the vasomotor fall in pressure continued. (Fig. 5). The cardio-inhibitory reflex was therefore central and the impulse to the centre was carried by the vagus nerves. Postmortem: Trocar left "in situ" was found to be pressing directly on the thoracic sympathetic nerve in the sixth space. Also marks of trocar on pleura of middle lobe. Vessels of stomach, intestines, liver, etc., much congested.

EXPERIMENT 45. The dog forty-eight hours previously had been given 10 c.c. of dirty oil in the right chest. Aspiration of the exudate was accompanied by a fall in pressure from 120 to 110 mm. Trocar irritation of the right and left visceral pleuræ was negative. Formalin 1 c.c. on the right pleura was followed by a slight fall; 1 c.c. of formalin in the left membrane caused a slight rise, then rapid fall from 130 mm. to 14 mm. The type of curve was vasomotor. During the descent of the blood pressure both vagi were cut in the neck, but no effect was seen; 0.5 c.c. of a 1 to 1000 solution of adrenalin injected into the femoral vein caused an instant rise from 16 mm. to 210 mm. Final recovery. During the low tension the respirations were slow and shallow. Postmortem: Right pleurisy marked with thick membrane over lung. Left side contains a small amount of fluid and a beginning pleurisy.

EXPERIMENT 46. Dog prepared by injecting, forty-eight hours previously, 225 c.c. dirty oil in the left pleural cavity. 150 c.c. of fluid aspirated from left side. Trocar irritations of left visceral pleura were negative. Trocar irritation of right visceral pleura showed a gradual fall from 120 mm. to 110 mm. Formalin 1 c.c. in right pleura caused a fall in blood pressure from 116 mm. to 80 mm., with shallow respirations. Recovery. Postmortem: Double pleurisy, more marked on left side.

EXPERIMENT 47. Injection of 200 c.c. of oil in right pleural cavity of dog forty-eight hours previously. 150 c.c. of purulent fluid was removed by aspiration. Atropine 1 mg. was given intravenously, until electrical stimulation of vagus caused no change in the heart action. Formalin 1 c.c. in right visceral pleura caused a vasomotor type of fall in pressure, with slower and shallower respirations. Cutting vagi had no effect on the curve. Death. Postmortem: Right pleurisy, with thick, fibrinous covering. Left pleurisy starting. Engorgement of abdominal viscera.

EXPERIMENT 48. Double pleurisy created in right side of dog by injecting forty hours previously 200 c.c. oil. 100 c.c. exudate aspirated from right side. Formalin 5 drops on right visceral pleura within a minute set up long strokes, with slowing of respiration. At first the blood pressure rose, then fell. Atropine 1 mg. in femoral vein caused an immediate cessation of the "vagal" strokes. Electrical stimulation of vagus in neck gave no reaction. Then 1 c.c. formalin was blown upon left visceral pleura. Soon a vasomotor type of fall in pressure developed and death ensued. Here the atropine abolished the "vagal" reflex, but not the vasomotor. Postmortem: Brain normal. Right pleura covered with thick layer of lymph. Left pleura moderately inflamed. Congestion of abdominal vessels.

EXPERIMENT 49. A double bilateral pleurisy followed forty-eight hours after introducing 200 c.c. of dirty oil in right thorax. After the removal of about 50 c.c. of exudate from the chest the blood pressure showed little change. The application of 0.5 c.c. of formalin

to the right visceral pleura caused the long strokes with a mean fall in pressure of about 25 mm. Upon administering a milligram of atropine the long strokes quickly changed to short and more rapid stroke. This experiment indicates that the long strokes were due to excitation of the cardio-inhibitory branches of the vagus, since they disappeared when these fibers were paralyzed by atropine.

EXPERIMENT 50. A dog with a bilateral pleurisy, forty hours after the introduction of 200 c.c. of contaminated oil in the left pleural cavity. Initial blood pressure was 120 mm. After slow aspiration of over 100 c.c. of fluid the pressure was 100 mm. The injection of 1 c.c. of formalin on the left visceral pleura was followed by slow and shallow breathing and by a rapid fall in blood pressure to about 20 mm., with frequent long strokes. Immediate section of both vagus nerves in the neck caused a sudden rise in pressure to 75 mm., with increased rapidity of pulse, but the recovery was only transitory. The second fall was rapid and free from long strokes. Postmortem: About 50 c.c. of fluid in the left cavity and fibrin deposits. Right fibrinous pleurisy, with no free fluid. Engorgement of abdominal bloodvessels. We may infer that two reflexes conspired to depress blood pressure in this experiment; the one acting on the medullary centre through the vagus nerves and eliminated by section of the same; the other, of vasomotor type, causing vasodilatation of the abdominal vessels and not affected by section of the vagi.

EXPERIMENT 51. A dog had been injected in the right pleura over forty hours previous to experiment with 10 c.c. of contaminated oil. About 50 c.c. of exudate was aspirated without any influence on pressure. Then about 200 c.c. of a 1 per cent. formalin solution was forced into the pleural cavity, care being taken to avoid pneumothorax. The fluid was then allowed to flow out by siphonage. The irrigation was accompanied by marked slowing of respiration and a combined type of cardio-inhibitory and vasomotor pulse tracing. Respirations then ceased entirely, section of both vagi in the neck abolished the "vagal" strokes, but the pressure continued to fall until it reached about 10 mm. Hg.; then spontaneously breathing started up again and the blood pressure arose steadily. The animal recovered. (Fig. 6).

SUMMARY OF EXPERIMENTS. Aspiration of oil from the pleural cavity of 6 healthy dogs caused only a slight lowering of blood pressure. Aspiration of oil from the chest of 7 dogs in which pleurisy had been produced caused in 3 little effect, in 3 a considerable fall in pressure and in 1 death.

Irritation of the visceral and parietal pleura in 9 healthy dogs produced no marked effect upon blood pressure.

In the group of 6 pleurisies produced by turpentine 16 per cent. gave a marked blood-pressure-lowering reflex in response to irritation of the trocar, while 50 per cent. gave such a reflex from formalin irritation.

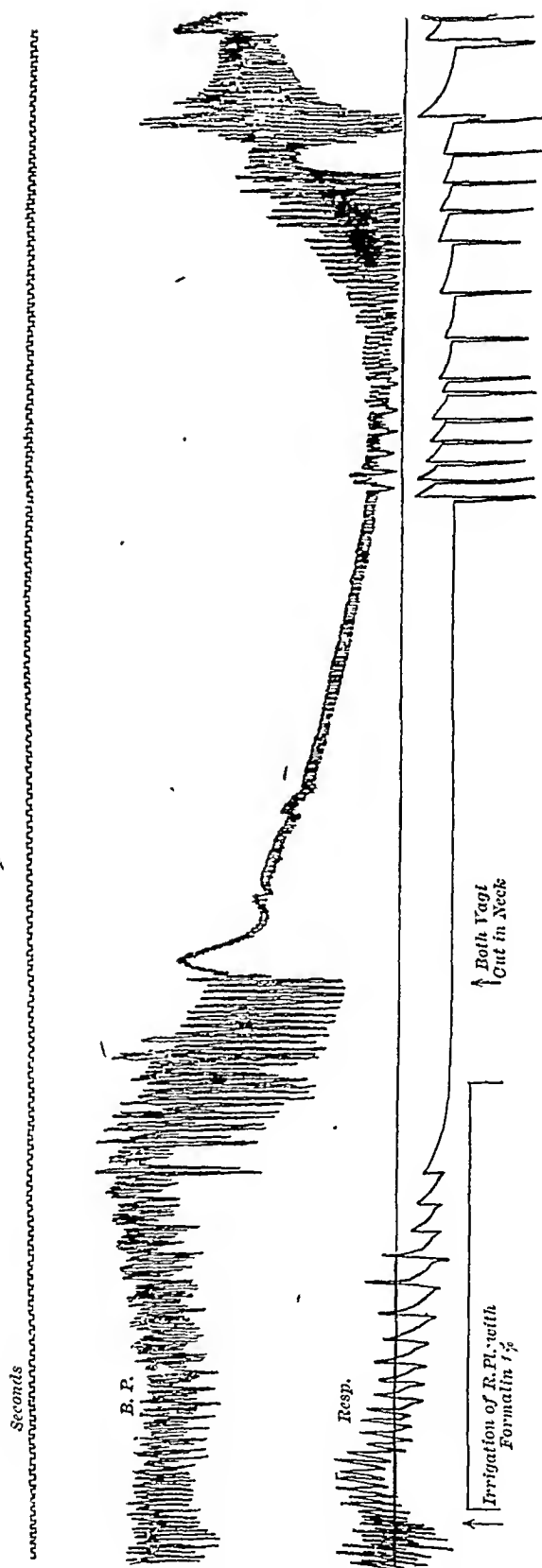


FIG. 6.—*Combined cardio-inhibitory and vasomotor reflex* resulting from irrigation with 1 per cent. formalin in glycerin of pleural cavity of dog with artificial empyema. At the top is the time record in seconds. Upper tracing represents blood pressure, the lower respirations, between them the base line. Respirations ceased at beginning of long strokes. Section of both vagi in the neck abolished the long "vagal" strokes, but the vasomotor fall continued. Respirations and blood pressure recovered spontaneously.

Of the group of 5 pleurisies caused by the injection of oil contaminated with bacteria and operated on within twenty-four hours after injection, 20 per cent. showed from the trocar irritation a decided blood-pressure-lowering reflex and 25 per cent. from formalin irritation.

In the group of 17 pleurisies induced by the presence of bacterially contaminated oil in the chest for forty-eight hours or more, 42 per cent. responded to the trocar irritation with a marked depressing reflex and 46 per cent. responded in like manner to the formalin.

Of the total 28 cases of pleurisy of all kinds, 33 per cent. gave a marked blood-pressure-lowering reflex from trocar irritation, while of a total of 17 cases in which formalin irritation was employed, 47 per cent. exhibited a decided fall in blood pressure.

Artificial respiration with the thorax opened tends to abolish all reflexes from irritation of the viscera, as was first pointed out by Brodie and Russell.

It is noteworthy that the trocar irritation seldom gave rise to this reflex in the turpentine pleurisies and in the bacterial pleurisies of short duration, but frequently caused it in the bacterial pleurisies of longer duration. The formalin,* on the other hand, induced the reflex in one-half of the turpentine pleurisies and with about the same frequency in bacterial pleurisies of both long and short duration.

Why the reflex occurred in some cases and was entirely lacking in others was explained in part only. In certain instances a very *thick fibrinous exudate* was found, which may have protected the pleura from injury and thus prevented the reflex. But in most cases this variability of reaction was not made clear by anatomical conditions.

The *location* of the irritation was of some importance. The nearer the irritant approached the root of the lung where the fibers of the pulmonary nerves spread out, the more likely was the reflex to occur. The fall in blood pressure arising from mechanical irritation was usually of the vasomotor type; the fall arising from formalin irritation was sometimes of the vasomotor, sometimes of the cardio-inhibitory type, and occasionally seemed to be a combination of both types. It may be noted that the cardio-inhibitory type, though often alarming in its symptoms, never alone caused the death of an animal. The vasomotor type of reflex, however, was always dangerous and several times fatal. Twice death was prevented by adrenalin injections.

* Subsequent experiments indicate that when formalin is introduced in *large quantity*, say 2 to 20 c.c. in the pleural or peritoneal cavity of healthy dogs, a marked lowering of blood pressure often occurs, due in part to absorption in the circulation. We believe, however, that absorption plays a minor rôle when formalin is applied to the visceral pleura in small quantities.

ANATOMICAL COURSE OF THE REFLEXES. Before discussing the possible courses of these reflexes it seems advisable to review the innervation of the pleura and heart of the dog, and the anatomical arrangement and course of the fibers in the pneumogastric and sympathetic nerves.

The bronchial branches arising from the pneumogastric nerves are given off from the ventral and dorsal aspects of the nerve a little aboral to the aortic arch. The ventral branches pass along the large vessels and accompany the bronchi into the lungs, while the dorsal branches pass along the œsophagus, trachea, and lymph nodes to the root of the lung.

All these fibers unite to form at the root of the lung an extensive network, which is called the pulmonary plexus. The part of the plexus which usually lies upon the principal bronchus and more on the ventral surface is called the anterior pulmonary plexus, while the part lying aboral to the principal bronchus is called the posterior pulmonary plexus. These two plexuses are connected by branches, and the pulmonary is connected with the cardiac plexus.

The stellate ganglion marks the beginning of the thoracic part of the sympathetic ganglionated cord. It is oval and flattened, and lies lateral to the vertebræ upon the m. longus colli at the level of the second rib, and also extends downward to the second intercostal space. From this ganglion are distributed a number of branches, to the first and second thoracic nerves, the lower cervical nerves, and the two cardiac branches (rami accelerantes cordis), which assist in the formation of the cardiac plexus lying upon the lateral surface of the aortic arch and the base of the heart.

The cardiac plexus sends fibers into the pulmonary plexuses above described, from which branches are distributed along the vessels and bronchi to the pleura. Small sympathetic ganglia are interposed at frequent intervals along the nerves. Branches are given off from this plexus, of which the vagus also forms a part, that supply the pericardium and heart muscles. The pleura is innervated therefore by elements of both sympathetic and vagus nerves.

The vasoconstrictor nerves of the body leave the spinal cord by the anterior roots of the spinal nerves from the first dorsal to the third or fourth lumbar inclusive. From the roots they pass by the white rami communicantes to the ganglia of the sympathetic chain lying along the front of the vertebral column. Here they take different courses according to their destinations. The fibers for the head and neck leave by the first four thoracic nerves, pass into the sympathetic chain through the stellate ganglion and the ansa Vieussensii to the inferior cervical ganglion, and up the cervical sympathetic trunk to the superior cervical ganglion. Here they end, and the impulses are carried by a fresh relay of fibers, starting from cells in this ganglion and travel along non-medullated fibers on the walls of the carotid artery and its branches.

The most important vasomotor nerve is the splanchnic nerve. This nerve receives most of the fibers forming the white rami from the lower seven dorsal and upper two or three lumbar roots, the latter fibers often taking a separate course in the lesser splanchnics. The fibers can be seen to pass through the sympathetic chain of the thorax without interruption and for the most part have their cell station in the large ganglia, especially the semilunar ganglia of the solar plexus, whence a thick meshwork of non-medullated fibers is distributed along all the vessels of the abdominal viscera. The area of vessels innervated by this nerve is so large that section of this nerve on each side causes a large fall in general blood pressure.

THE CARDIO-INHIBITORY REFLEX.—The typical cardio-inhibitory reflex obtained by irritation of the inflamed pleura corresponds to that elicited by electrical stimulation of the vagus nerve in the neck. The blood-pressure tracing shows long downward strokes, with a marked difference between systolic and diastolic blood pressures, slowing or temporary arrest of the pulse, and frequently slowing of the respiration. Unless the current is very strong the heart overcomes the inhibitory action and the blood pressure returns to its original level. This reflex was never obtained in healthy dogs by trocar irritation of the pleura or of the thoracic sympathetic nerves. Long, single strokes without slowing of the heart were frequently obtained by scratching the root of the lung or the thoracic portion of the vagus nerve itself or by striking the pericardium with the trocar. These latter curves have very little effect on the mean blood pressure, and because of their slight importance were not recorded as pathological cardio-inhibitory reflexes.

We believe that the cardio-inhibitory reflex resulting from irritation of the inflamed pleura was usually of central origin, arising in the afferent branches of the vagus and travelling upward through the pulmonary ganglia to the combined nucleus of the vagus and accessory nerves in the medulla, the inhibition being transmitted along the accessory fibers to the vagus nerve back to the cardiac plexus and finally to the heart. (Fig. 7.) We believe the reflex to be of central origin, as it was usually absent after section of both vagi.

Atropine in the dosage of 1 mm. injected into a vein either diminished or prevented the reflex.

VASOMOTOR REFLEX. The vasomotor (dilator) reflex differs from the cardio-inhibitory in that the long "vagal" strokes are usually wanting and the mean fall in blood pressure is progressively downward, often resulting in death. The respiration may or may not be slowed. The nature of this reflex may be made clear by the following evidence:

1. Acute engorgement of the vessels of the abdominal viscera was found in all cases, evidently from acute vasodilatation.
2. Section of the vagi in the neck did not prevent the reflex or

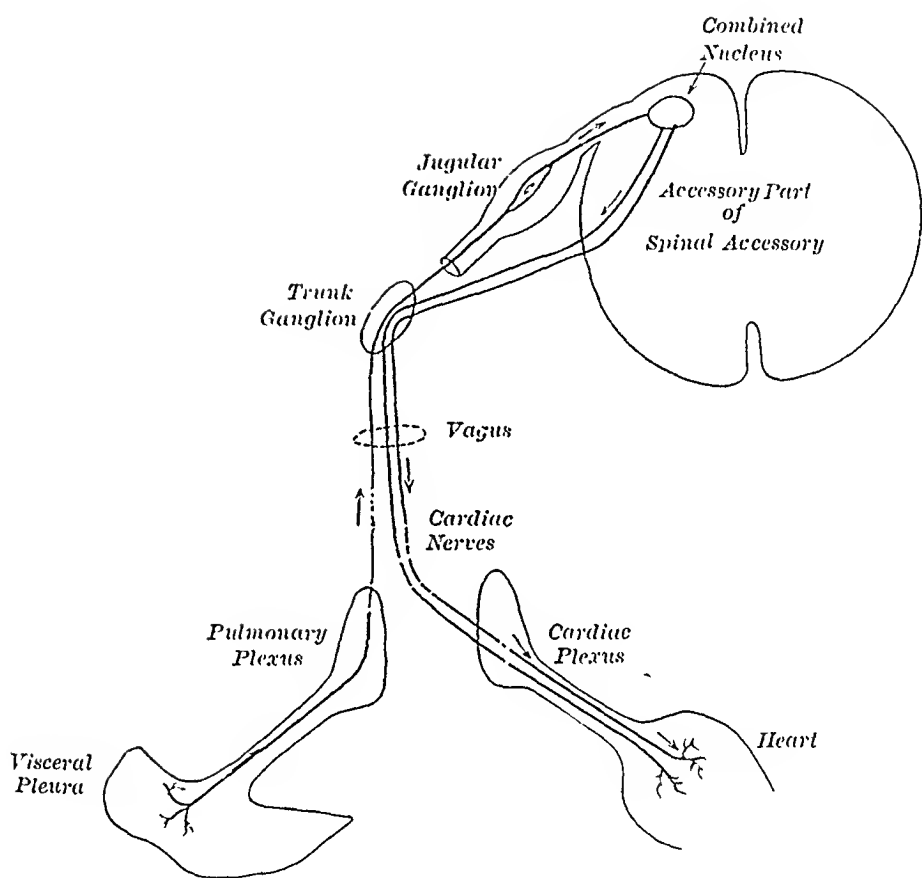


FIG. 7.—Illustrating the course of the cardio-inhibitory reflex. The impulse is carried by the afferent fibers (blue) from the visceral pleura, through the vagus, to the medulla; thence back to the heart by the efferent nerves (red).

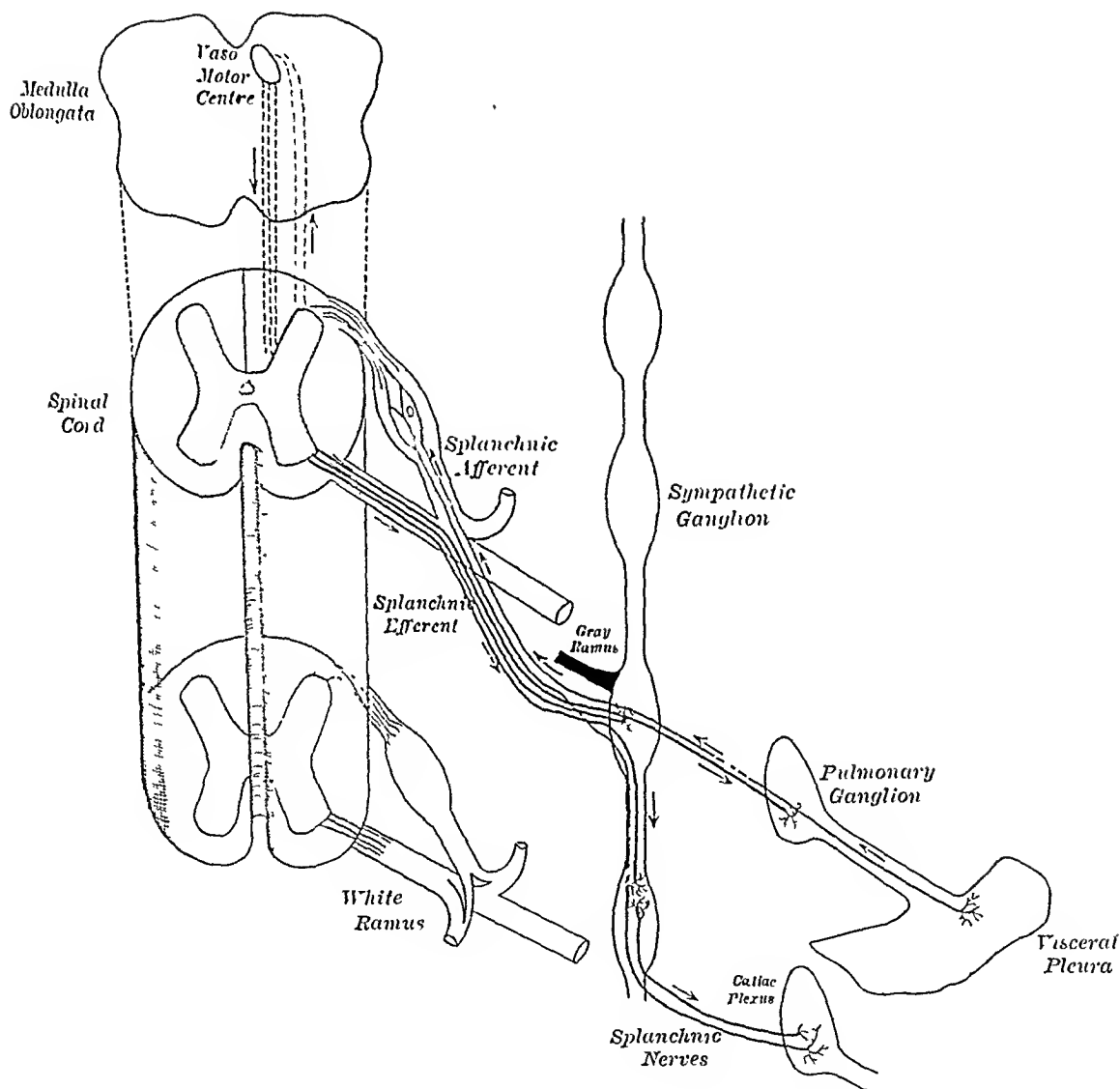


FIG. 8.—Illustrating the course of the vasomotor reflex. The impulse is conducted by the afferent nerves (blue) from the visceral pleura, through the pulmonary ganglia, the sympathetic cord, and the posterior roots to the vasomotor centre in the medulla. From there it is carried by the efferent nerves (red) along the anterior roots, sympathetic cord, and splanchnic nerves to the celiac plexus.

alter it after it was induced, which indicates that the reflex was independent of any inhibitory action of the heart.

3. Intravenous injection of adrenalin, a vasoconstrictor, opposed the reflex, causing an immediate rise in blood pressure. Twice the injection of adrenalin solution saved the life of the animal. Atropine, on the other hand, which paralyzes the cardio-inhibitory fibers of the vagus, had no effect.

According to our present knowledge of the course and distribution of the nerves of the sympathetic system it seems probable that this reflex is central rather than peripheral, that is, that the afferent impulse is carried back to the principal vasomotor centre in the medulla or subsidiary centres in the cord, and that the efferent impulses are then transmitted along the white rami to the collateral ganglia. As the reflex is accompanied by such a marked fall in blood pressure it seems probable that the reflex occurs through the principal rather than the subsidiary centres.

The afferent fibers represented in blue (Fig. 8) probably traverse the sympathetic cord, passing upward, downward, and outward without arborizing about these cells in the ganglion and, therefore, without losing their medullary sheath. It is quite generally accepted now that the afferent fibers which are sensory have this arrangement. A reflex beginning in the pleura will traverse these fibers, passing through the posterior root, and the reflex may be established at the level at which the fibers enter the cord, or they may pass upward to arborize about the cells in the principal vasomotor centre in the medulla. This anatomical arrangement precludes the possibility of a more direct reflex arising from the pulmonary plexus and travelling directly along the thoracic ganglionated cord to the splanchnic vessels.

It should be mentioned, however, that Dogiel⁷ has described a different arrangement of the fibers in the sympathetic cord, and if his interpretation is correct a peripheral reflex arising in the peripheral plexuses and traversing directly the ganglionated cord is possible.

We have already noted that the effects of this reflex are so general and rapid that it seems probable that the principal vasomotor centre is affected and not the subsidiary centres situated in the cord.

CLINICAL OBSERVATIONS IN MAN. The following observations were made in man to ascertain if irritation of the inflamed pleura during thoracentesis produced any marked changes in blood pressure:

CASE I.—The patient had a pleurisy with effusion of over two weeks' duration. Thoracentesis in midaxillary line, sixth space. Fluid was seropurulent and contained pneumococci. The initial blood pressure was 100 mm. Hg. After withdrawal of 125 c.c. of fluid the flow ceased. Blood pressure, 98 mm. The trocar was then moved about in the endeavor to start the flow. The visceral pleura

⁷ Poirier et Charpey, *Traité d'anatomie humaine*.

was distinctly felt against the trocar during these movements. The blood pressure rapidly fell to 80 mm. when the instrument was withdrawn. In four minutes the blood pressure had risen again to 96 mm.

CASE II.—Man with a right-sided streptococcic empyema of over a month's duration. Needle inserted near angle of scapula. Initial blood pressure 105 mm. Hg.; after entrance of needle, 98 mm. As no fluid escaped, the needle was moved about and the pleura intentionally scratched with the end. The blood pressure fell immediately to 88 mm. and after a short rest recovered to 94 mm. A few more scratching movements caused a rapid fall to 84 mm. with intermissions of the pulse. Exploratory puncture was then made in the midaxillary line, in the sixth space. Blood pressure after entrance of needle, 90 mm. No fluid was obtained. A few lateral movements of the needle were made against the visceral pleura, when the systolic blood pressure fell to 75 mm., the diastolic pressure below 35 mm., and for a few seconds the pulse could not be felt. Patient felt slight dizziness and faintness. Upon withdrawal of needle the pulse rapidly improved and the subjective symptoms disappeared.

CASE III.—Right pleurisy with bloody effusion. At postmortem a month later, the lung was found retracted and tied down with tuberculous adhesions. Trocar in sixth space, midaxillary line. Initial blood pressure 89 mm. Hg. After insertion of trocar 79 mm. 1200 c.c. of fluid was withdrawn by siphonage without discomfort. Blood pressure, 69 mm. Then the trocar came in contact with the visceral pleura and, although very little more fluid escaped, the blood pressure fell in a few minutes to 57 mm. and the patient complained of faintness, dizziness, and a dull pain at the site of the needle. The pulse beats were very difficult to feel and at times were intermittent. The trocar was removed and in three minutes the blood pressure was 62 mm. Lying down increased blood pressure to 67 mm. Thirty minutes later blood pressure was 80 mm. and the patient was comfortable.

CASE IV.—Left pleurisy of ten days' duration. Thoracentesis in postaxillary line, seventh space. During the withdrawal of 1500 c.c. of fluid by slow siphonage no pain was experienced, and the blood pressure fell from 106 mm. to 100 mm. Scratching the visceral pleura gently with a needle was followed by only slight pain and a fall in blood pressure to 90 mm. In four minutes after needle was removed the blood pressure was up again to 100 mm.

CASES. V, VI, and VII were all acute pleurisies with serous effusions. In all cases there was very little reflex fall of blood pressure from irritating the pleura with the trocar.

CASE VIII.*—Man of thirty years with left pleurisy and tuberculosis of the left lung. Thoracentesis in sixth space midaxillary

* This case was published by Capps, loc. cit.

line. Initial blood pressure 120 mm. Hg. After insertion of needle 130 mm. 2000 c.c. of serous fluid aspirated in nine minutes, when blood pressure was 105 mm. The needle end then came suddenly in contact with the visceral pleura and patient complained of dull pain in the epigastrium, but none whatever in the chest. The pain grew rapidly worse and the blood pressure rose steadily to 155 mm.—an increase of 50 mm. in the course of five minutes. Upon withdrawal of the needle the epigastric pain gradually subsided and the blood pressure simultaneously was lowered. Twelve minutes after the maximum anginal pain the blood pressure had returned to 108 mm. and the pain was gone. There is every reason to believe that excitation of the visceral pleura in this instance caused a reflex *vaso-constrictor* action on the abdominal arteries.

These observations go to show that in man, as in dogs, irritation of the inflamed pleura often gives rise to a blood-pressure-lowering reflex of cardio-inhibitory or vasodilator type. Also that similar excitation under similar conditions may give rise to a reflex of vaso-constrictor type, with heightening of blood pressure. This latter type of reflex is exceptional and has been observed only in this 1 case out of a total of over 30 patients in whom careful blood-pressure readings have been taken during the progress of aspiration. In our experiments on the pleurisies of animals we have never seen such a striking vasoconstrictor reflex, but several times a gradual rise in blood pressure has followed pleural irritation, which may possibly be explained in this manner.

ILLUSTRATIVE CASES IN LITERATURE. It does not lie within the scope of this paper to discuss the numerous cases recorded in literature of collapse or sudden death occurring in the course of operations in the thorax in which no satisfactory cause could be found postmortem. But it may be pertinent to allude briefly to a few writers who have helped to elucidate the phenomenon.

Sears⁹ has recently published a full bibliography besides reporting a case in which death followed fifteen hours after exploratory puncture. Russell¹⁰ described 3 cases, 2 of them children, that died after exploratory puncture and gives the most instructive discussion of the subject at our command. As previously stated he considers that in these cases the needle penetrates the lung tissue and excites vagus nerve endings in the alveoli. He believes that the pleura takes no active part in the reflex—a conclusion entirely opposed to our own. Leichtenstern¹¹ reports three groups of fatal cases that occurred from operative procedures: 4 patients died suddenly during aspiration; 15 patients died a few minutes to a few days after operation; 5 patients died during irrigation of the pleural cavity, some with partial or general convulsions. Rosenbach¹² reported a sudden death

⁹ Trans. Assoc. of Amer. Phys., 1906.

¹⁰ Loc. cit.

¹¹ Deutsch. Arch. f. klin. Med., 1879, xxv.

¹² Loc. cit.

from irrigation of the pleural cavity in a patient with empyema, in which the postmortem findings were entirely negative. He attributed the probable cause of death to irritation of the vagus-nerve endings. He alludes also to an interesting historical case of sudden death resulting from the accidental loss of a part of a syringe in the pleural cavity following an operation for empyema. Auberne¹³ describes convulsive attacks accompanying irrigations of the pleura which are sometimes followed by syncope and death, at other times by recovery after a short interval without any bad consequences. Weill¹⁴ refers to similar convulsive movements during irrigation of the chest, especially on the affected side. The convulsions are usually explained by an anemia of the brain which accompanies the reflex fall in the blood pressure (Russell, Rosenbach).

¹⁴ From these illustrations it is evident that the pleural reflex lowering blood pressure may be caused by a number of forms of irritation of the pleura: (a) by irritation or injury of the needle, (b) by a foreign body in the pleural cavity; or (c) by irrigations of the cavity with antiseptic solutions. Obviously if the susceptibility of the inflamed $\frac{1}{2}$ pleura to dangerous reflexes were fully appreciated, greater care would be used by physicians and surgeons to avoid any unnecessary injury or irritation of the membrane during operations and irrigations.

CONCLUSIONS. 1. Aspiration of oil from the pleural cavity of healthy dogs causes little or no change in the arterial pressure.

2. Aspiration of inflammatory exudate from the pleural cavity of dogs with acute pleurisy often causes a more marked fall in blood pressure. This fall in pressure depends more on the degree of trauma or irritation of the inflamed pleura than on the amount of exudate withdrawn or the rate of withdrawal.

3. Irritation of the visceral pleura of healthy dogs by mechanical, thermal, and electrical means and by certain chemicals, produces little or no effect on blood pressure, except over the roots of the lungs, where mechanical and electrical excitations produce long strokes of vagal type.

4. The effect of irritation of the parietal pleura needs further investigation. The common drop of blood pressure and disturbance of respiration occurring when the trocar is forced through the chest wall into the cavity is probably due to injury of the parietal pleura. The reflex is usually transitory and is seen in both normal animals and in those with pleurisy.

5. In dogs with pleurisy induced by turpentine or by oil contaminated with bacteria, excitation of the inflamed visceral pleura by mechanical and chemical irritants gives varying results. In some cases there is no marked change in blood pressure; in others there is a considerable fall in pressure that may even be fatal.

¹³ *Revue de m d. et chir.*, February, 1870.

¹⁴ *Ibid.*, January, 1887.

6. These reflexes conform to two types, which as a rule occur singly, but may be combined: (a) The cardio-inhibitory type, in which the heart is slowed and the pulse tracings make violent excursions with a great range between systolic and diastolic pressure. Respirations also are usually slowed and may be inhibited. This type of reflex when it occurs alone is seldom fatal. (b) The vasomotor type, in which the pulse tracings show a steady rapid decline of pressure without a great difference in systolic and diastolic pressure and frequently terminate in death. Respirations as a rule are shallow and may be rapid. In fatal cases the bloodvessels of the abdominal viscera are much engorged from acute vasodilatation. The brain shows no evidence of embolism or hemorrhage.

7. The cardio-inhibitory reflex is central, because it is prevented or stopped by cutting both vagus nerves in the neck. Atropine in a dosage of 1 milligram paralyzes the cardio-inhibitory fibers and destroys the reflex.

8. The vasomotor (dilator) reflex may be central or peripheral. If central, the afferent impulses reach the medulla by way of the thoracic sympathetic, the white rami, and the cord, and not by the vagosympathetic cord. This is proved by the failure of section of the vagosympathetic cord to alter or abolish the reflex. If peripheral, the reflex goes from the pulmonary fibers to the pulmonary plexus, thence to the thoracic sympathetic nerves and downward through the splanchnics to the celiac and other plexuses in the abdomen. This reflex is more direct than the central form, but seems to us inconsistent with the views generally accepted as to the course and direction of impulses in the sympathetic nerves. Adrenalin is the physiological antagonist to the vasodilator reflex and is often life saving. Atropine on the other hand, by its tendency to dilate the cutaneous vessels and lower the mean arterial pressure, seems to intensify the reflex. There is some evidence that the previous administration of atropine modifies the blood pressure—elevating action of adrenalin and thereby deprives it of its full beneficial effect.

9. These types of reflexes occur also in man during operative procedures upon the inflamed pleura. The cardio-inhibitory type is manifested by a slow intermittent pulse, with a great difference between systolic and diastolic pressures; the vasomotor type by a steady fall in blood pressure, without a marked difference in systolic and diastolic pressures, and by a pulse that grows steadily weaker until it cannot be felt.

10. For emergency use in case of falling blood pressure and symptoms of collapse adrenalin intravenously is indicated. Atropine is of little service and may even do harm.

11. Preventive measures come readily to mind. The instrument used in thoracentesis should not irritate the visceral pleura any more than is absolutely necessary. Therefore, the trocar is preferable

to the needle. The trocar should not be inserted at a greater depth than is necessary to obtain fluid. Great care should be employed during the drainage of an empyema, especially to avoid a long projection of the drainage tube inside the cavity. Swabbing the pleural surface is attended with danger. Finally we would emphasize the clinical importance of taking blood-pressure readings at the beginning of and during all operations in the pleural cavity, in order to forestall and thereby prevent the development of a dangerous blood-pressure lowering reflex.

We gratefully acknowledge our indebtedness to Dr. S. A. Mathews, the director of the laboratory, for his constant assistance and encouragement.

REVIEWS.

THE PRINCIPLES AND PRACTICE OF MEDICINE. By ARTHUR R. EDWARDS, A.M., M.D., Professor of the Principles and Practice of Medicine and of Clinical Medicine in the Northwestern University Medical School, Chicago, Illinois. Pp. 1328; 101 engravings, and 19 plates. Philadelphia and New York: Lea Bros. & Co., 1907.

DR. EDWARDS has prepared a *Practice of Medicine* which, although it follows familiar lines in many respects (and this from the nature of the subject can scarcely be avoided), yet possesses a sufficiency of individuality to arrest attention. The classifications adopted are those usually followed, and the treatment of much of the subject matter is very much what one expects. But, as the author states in the preface (and his statements are confirmed by a perusal of the book), as far as possible, the causative pathology has been blended with the consecutive clinical features of disease, reasons have been given for facts, exceptions have been subordinated to what is usually found at the bedside, and the allurements of typical clinical pictures and dogmatic generalizations have been avoided because they hold neither in practice nor at the postmortem table. The pathological and clinical descriptions are clear, concise, and accurate: this is especially true of many of the infectious diseases and diseases of the nervous system. But, here and there, especially in the sections devoted to diseases of the heart and of the gastrointestinal system, the style adopted does not lend itself well to an orderly description of the evolution of the diseases in question—which is especially important from the point of view of the student. There is a large number of excellent tables illustrating the differential diagnosis of diseases likely to be confused, and tables of diseases of certain organs, such as the liver and the kidneys, and of the eruptive diseases and diseases of the typhoid group. In these and in general in the paragraphs devoted to differential diagnosis there is often a wealth of facts not to be found in other works of a similar kind. An unusual amount of space has been devoted to treatment, to the detailed consideration of drugs, and to numerous formulæ and prescriptions ready, as the author states, for the student to use or improve upon. The physiological action of drugs has been dwelt upon because, in the author's experience, the symptoms of

disease are often confounded with those of the remedies exhibited for its cure. This is an excellent feature of the book—wisely undertaken and well executed. Considerable attention also has been devoted to the indications for and the results of surgical intervention in many of the so-called borderland diseases.

As a whole, the book impresses the reviewer very favorably; he recommends it to the attention of students, practitioners, and teachers, in the belief that when tried it will not be found wanting, but will be always of service.

A. K.

GYNECOLOGY AND ABDOMINAL SURGERY. Edited by HOWARD A. KELLY, M.D., F.R.C.S., Professor of Gynecological Surgery in the Johns Hopkins University; and CHARLES P. NOBLE, M.D., Clinical Professor of Gynecology in the Woman's Medical College of Pennsylvania, Philadelphia. Vol. I; pp. 851; 405 original illustrations by Hermann Becker, Max Brödel, and others. Philadelphia and London: W. B. Saunders Co., 1907.

WE have looked forward with eager pleasure to the publication of the present work from the early stages of its preparation, and therefore it gives us an added measure of satisfaction to be able to say that careful reading of this first volume has not left us with a sense of disappointment. It is needless to say that the work has been thoroughly done: the names of the authors and editors would guarantee this, but much may be said in praise of the method of presentation, and attention may be called to the inclusion of matter not to be found elsewhere. We are greatly pleased with the character of the illustrations prepared by Messrs. Becker and Brödel, and we would particularly call attention to the insertion of the bibliography at the foot of the page. This is a German method which has but too few imitators in this country. Every book which makes any pretensions to authority should give ample space to the citation of references to the original sources of information, and it gives us great pleasure to note this admirable feature of this book. In addition we would call especial attention to the historical *resume* which precedes the consideration of each subject. The history of medicine is but too little considered in the rush of present-day work, and we therefore welcome most heartily this variation from the usual.

Three of the authors of the volume have died since the inception of the work, Drs. Skene, Pryor, and Hentrotin, and their articles must have an added interest in that they are the last contributions of these well-known men to surgery. Considering the book from the standpoint of technical criticism, there is but little to regret and much to praise. Of course, it would be possible to find some typographical errors by careful search; probably there might have

been more illustrations inserted in certain portions and fewer in others, or other equally valueless criticisms which might pass as an erudite review might be made, but if one reads the book with a remembrance that the authors make no claim to superhuman attributes we feel certain that the verdict will be unqualifiedly favorable. The editors, Drs. Kelly and Noble, have been most happy in the choice of their collaborators; the names of Ford, Clark, Baldy, Hurd, Fullerton, Werder, Henrotin, Hurdon Edebohls, Anspach, Hunner, Skene, McMonagle, Byford, and Webster, with the editors, Drs. Kelly and Noble, are sufficient assurance to the man versed in the gynecological literature of the present day of the excellence of the work. A detailed description of the contents of the volume is impossible because of lack of space, but we would call attention to the chapter by Kelly upon gynecological technique, to Ford's discussion of bacteriology, to Hurdon's presentation of the pathology of the reproductive organs, which chapter appeals to us as the best we have ever read, and to the elaborate chapter by Noble and Anspach upon medical gynecology. This last-mentioned portion of the book is one of the landmarks of the work, its inclusion reflecting as great credit upon the sagacity of the editors as does its excellence upon the ability of the authors. It is unique in scope, covering more than one hundred pages. The chapter by Edebohls upon the history of the development of the combined gynecological operation is of great interest, and Hunner's chapter upon the bladder and urethra is particularly well done. Baldy's chapter, upon hysterectomy in the presence of inflammatory disease of the uterine appendages, is characteristically clear and concise, while Noble's abdominal hysteromyomectomy and myomectomy has the charm which attaches to the work of the enthusiast. We are particularly pleased to note his stringent limitations of the latter procedure. Fullerton and Noble divide the operative procedures upon the external genitalia, the former considering the non-plastic work, while the latter devotes his attention to the repair of the injuries incident to childbirth, etc. A special section is devoted to ventrosuspension by McMonagle. To Skene has been assigned ovariectomy, including the clinical history and diagnosis of ovarian tumors, while vaginal section for disease of the ovaries and tubes is described by Byford. The chapter by Webster upon the abdominal removal of these organs completes a most satisfactory study of this whole subject. Clark considers the radical operation by the abdominal route in the presence of cancer of the uterus. An interesting historical *resume* is given, the illustrations are especially good, and, while his conclusions may be differed from in part, the fairness of his presentation is most gratifying. We are glad that just at this time and in a book of this character it has seemed good to include a description of the Byrne method of attack. Werder makes the chapter extremely interesting and his modification of the original plan is well worth study and consideration.

is nursing. There is, doubtless, a modicum of truth in this, but there is a special danger attendant upon the use of such books—that pertaining to all superficial and misdirected knowledge. Apart from some tendency in this direction, Dr. Register's book is excellent, especially the chapters on general considerations and prophylaxis.

Paul's *Nursing in the Acute Infectious Diseases* is a much smaller book, which, however, contains the essentials of the subject. The author discusses first the fever process and nursing in general; then special nursing in the different infectious processes; and finally certain related subjects of value in connection with caring for fever patients. The book is excellently adapted to serve as a first book on the subject in training schools, and might well be followed by the use of Register's.

Paul's *Materia Medica for Nurses* is divided into six parts—general considerations (drug constituents, preparations, etc.); general materia medica, therapeutics, and toxicology; drugs of minor importance; newer medicinal agents; practical therapeutics; and certain addenda (weights and measures, etc.). The book is excellent in every way—the author having struck the happy medium between too much and too little.

Stoney's *Materia Medica for Nurses*, now in its third edition, has been well tried and much commended. As is well known, it comprises an excellent discussion of familiar topics, and it has been revised in accordance with the new Pharmacopœia.

DeLee's *Obstetrics for Nurses* is an unusually good book, containing perhaps a little too much of purely medical information more suitable for the junior medical student than for the nurse, but assuredly well adapted to the purposes in mind. The author has succeeded well in combining obstetrics for nurses with obstetric nursing, so well, indeed, that young physicians might read the book with profit. The book is exceedingly well illustrated, largely from photographs of actual obstetric scenes. A glossary of obstetric terms adds much to the value of the volume.

A. K.

TROPICAL MEDICINE, WITH SPECIAL REFERENCE TO THE WEST INDIES, CENTRAL AMERICA, HAWAII, AND THE PHILIPPINES, INCLUDING A GENERAL CONSIDERATION OF TROPICAL HYGIENE. By THOMAS W. JACKSON, M.D., Lecturer on Tropical Medicine, Jefferson Medical College, Philadelphia, etc. Pp. 536; 106 illustrations. Philadelphia: P. Blakiston's Son & Co., 1907.

THE author states that his purpose has been to prepare for American medical men and students a simple and systematic presentation of the known and determined facts concerning such tropical diseases

improved in accordance with the advances in our knowledge of microscopic anatomy. In the latest edition, the especially noteworthy change consists in considerable amplification of the description of the structure of the nervous system; but many and important additions are to be found elsewhere throughout the book. One of its many excellent features is the division of the subject matter into fifty lessons—which provides a well-arranged and systematic course for students; another is the numerous diagrammatic and other illustrations. The book is to be much commended, especially since it aims at giving only the essential facts, unimportant details being omitted; and doubtless it will continue to enjoy the favor of teachers and students of histology. A. K.

PRACTICAL FEVER NURSING. By EDWARD C. REGISTER, M.D., Professor of the Practice of Medicine in the North Carolina Medical College. Pp. 352. Philadelphia and London: W. B. Saunders Co., 1907.

NURSING IN THE ACUTE INFECTIOUS DISEASES. By GEORGE P. PAUL, M.D., Assistant Visiting Physician to the Samaritan Hospital, Troy, New York. Pp. 200. Philadelphia and London: W. B. Saunders Co., 1907.

MATERIA MEDICA FOR NURSES, INCLUDING THERAPEUTICS AND TOXICOLOGY. By GEORGE P. PAUL, M.D., Assistant Physician to the Samaritan Hospital, Troy, New York. Pp. 242. Philadelphia and London: W. B. Saunders Co., 1907.

MATERIA MEDICA FOR NURSES. By EMILY A. M. STONEY, late Head Nurse, Mercy Hospital, Chicago, Illinois. Third edition. Pp. 300. Philadelphia and London: W. B. Saunders Co., 1906.

OBSTETRICS FOR NURSES. By JOSEPH B. DE LEE, A.M., M.D., Professor of Obstetrics in the Northwestern University Medical School, Chicago, Illinois. Second edition. Pp. 510. Philadelphia and London: W. B. Saunders Co., 1907.

THE foregoing form an excellent series of books for nurses. Register's *Practical Fever Nursing* is in many respects one of the best books on the subject with which we are acquainted, although perhaps it errs in presenting more of pathology, symptomatology, diagnosis, and treatment than reasonably should be expected of a nurse; but Dr. Register states his plan has been followed because of his belief that a nurse cannot know the cause and significance of many of the symptoms unless she knows something of the pathological processes that are going on within the body, nor can she anticipate all that is expected of her by the physician unless she is at least partly familiar with the history and treatment of the fever which she

the progress of the medical sciences required it, they have been carefully revised, so that we find them now, in their latest editions, fully representative of the present state of medicine. A large number of new words—in the larger dictionary as many as 2000, and many of them of the latest coinage—have been introduced. To the larger dictionary six new colored plates have been added—illustrating appendicitis, diphtheria, gallstones, Leishman-Donovan bodies, measles, and nephritis. The definitions in both books are excellent—clear, concise, and accurate, but there is some little inconsistency in the use of *c* and of *k* in spelling words derived from the same Greek root. Both dictionaries may be cordially recommended—the smaller to the junior student, the larger to the senior student and practitioner—as accurate, complete, and fully abreast of the present state of medicine and the allied sciences. A. K.

A MANUAL OF DISEASES OF THE NOSE, THROAT, AND EAR. By EDWARD B. GLEASON, M.D., LL.D., Clinical Professor of Otolaryngology in the Medico-Chirurgical College, Philadelphia. Pp. 556. Philadelphia and London: W. B. Saunders Co., 1907.

THIS book has been written, as stated in the preface, to supply the needs of students and general practitioners who desire the essential facts of laryngology and otology presented to them in as concise a manner as possible. The author's concise method of statement lends itself well to this object and his many years of experience as a teacher have acquainted him with his readers' needs. As might be expected, the book contains nothing strikingly original, nor does it vary greatly from the numerous other text-books on the subjects whereof it treats. It does, however, contain up-to-date descriptions of all the most recent advances in rhinology and otology, such as paraffin prosthesis and the various operative procedures upon the sinuses. The recent submucous operations for the correction of septal deformities are thoroughly described. The author gives in detail his own method for the correction of deflection of the septum, which has proved of great value in the hands of many other operators. For the student or general practitioner who wishes a reliable guide at the outset of his studies in laryngology and otology there are few books which can be more heartily commended than this of Gleason's. F. R. P.

as are found within the boundaries of our own country, and that the guiding ideas that have determined the size, scope, and character of the book have been utility and simplicity. The need of such a book is obvious, since, during recent years, tropical medicine has enlisted the interest not only of those public, medical officials whose duty brings them in contact with disease in our tropical possessions, but also of many civilian practitioners, of inland towns as well as seaports, who with increasing frequency are called upon to diagnose and treat imported tropical infections. How well the author has attained his object will be apparent to all who read the book. It begins with an excellent chapter on tropical hygiene, in which due attention is paid to divers causative factors, including the influence of mosquitoes and other insects, and measures of prophylaxis. Then follows a systematical discussion of diseases prevalent in the tropics: (1) Systemic diseases, such as cholera, beriberi, plague, dengue, dysentery, leprosy, malaria, Malta fever, and yellow fever; (2) animal parasitic diseases, such as ankylostomiasis, filariasis, trypanosomiasis, bilharzia disease and schistosomum japonicum, endemic hemoptysis, Guinea worm disease, liver and intestinal fluke worms, and intestinal cestodes and nematodes; and (3) diseases of undetermined causation, such as acute febrile icterus, epidemic dropsy, yaws, climatic bubo, etc. The descriptions of these diseases in general is quite accurate and satisfying, and reference is made to the latest results of researches in the field of etiology. Much that is interesting and instructive is more or less personal: for instance, the author's experience with imported cholera at a station thirty miles from Manila; the satisfactory results of immunization against cholera on the transport Sherman; reference to outbreaks of malaria at sea; the occurrence of afebrile malaria, etc. A very useful feature of the book consists of detailed instructions for the laboratory diagnosis of many of the diseases—appended at the end of the respective chapters. The book is really of much value and contains a considerable amount of useful information—well arranged and readable.

A. K.

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- THE AMERICAN ILLUSTRATED MEDICAL DICTIONARY. By W. A. NEWMAN DORLAND, A.M., M.D., Assistant Obstetrician to the Hospital of the University of Pennsylvania. Fourth edition; pp. 836. Philadelphia and London: W. B. Saunders Co., 1906.
- THE AMERICAN POCKET MEDICAL DICTIONARY. Edited by W. A. NEWMAN DORLAND, A.M., M.D., Assistant Obstetrician to the Hospital of the University of Pennsylvania. Fifth edition; pp. 578. Philadelphia and London: W. B. Saunders Co., 1906.

BOTH of these dictionaries, from the time of their original publication, have enjoyed an enviable reputation. From time to time, as

should be used for each determination of specific gravity, as there are some differences between the bulbs themselves. The specimen of urine should be approximately at the same temperature at each reading, or specimens with and without yeast may be kept side by side for controls and compared as regards their specific gravity. Christian says that observing these few precautions, results as accurate as with the other methods may be obtained, while its simplicity and cheapness should recommend it to more general use.

The Presence of Typhoid Bacilli in the Lice of Patients Suffering from Typhoid Fever.—ABE (from the clinic of Professor Matsushita in Kyoto, *Munch. med. Woch.*, 1907, liv, 1924) calls attention to the influence of parasitic insects in the spread of various infectious diseases. It is a well-known fact that the mosquito is a direct transmitter of malaria; flies often infect food with the bacilli of cholera and dysentery. Typhoid bacilli, as is well known, are present in the circulating blood in the majority of instances of typhoid fever. It is, therefore, easily conceivable that the various human parasites—lice, fleas, and mosquitoes—when they bite human beings affected with typhoid fever, contain the parasites. Pflügge and others have long been under the impression that such parasites might, under circumstances, transfer the infection. Tsujitani and Herzog have each cultivated the bacilli of plague with fleas which have bitten mice.

Abe collected lice and fleas from individuals infected with typhoid fever, soaked them for several minutes in a sterilized test tube in 0.1 per cent. corrosive sublimate solution and then, after having thoroughly washed them with sterile water, ground them up in a sterile mortar. This powder was inoculated under the skin of a white mouse and onto the culture media of Drigalski, Conradi, and Endo. The test tube which was used for the collection of the parasites was filled with 10 cm. of bouillon and placed for twenty-four hours in a thermostat at 37°. With this bouillon smear cultures were also made upon the above-mentioned typhoid media. The bacteria which grew from the typhoid-like colonies and in the internal organs of the animals in whom the injections were made were carefully tested by all modern methods. The results showed that the lice from the body and clothes of typhoid patients contained typhoid bacilli in three out of four cases; while fleas obtained from the nurses of typhoid patients in two instances failed to show bacilli. This latter result may depend upon the fact that but few fleas were obtained. The author concludes that the skin parasites of human beings "play, probably, an important role in the spread of the contagious diseases, especially in typhoid fever." [But the discovery that fleas and lice which have bitten typhoid fever patients contain typhoid bacilli is by no means proof that they are capable of conveying the disease by subsequent feeding upon a healthy individual.—W. S. T.]

Observations on Metabolism in Exophthalmic Goitre.—SCORDO and FRANCHINI (*Il Policlinico*, 1907, xiv, 285) report some studies made in Grocco's clinic on the metabolism in exophthalmic goitre. Their observations lead them to the conclusion which has been reached by many others, that emaciation with a relative loss of fat and albumin is by no means the absolute rule in this disease, nor is it dependent upon

PROGRESS OF MEDICAL SCIENCE.

MEDICINE.

UNDER THE CHARGE OF

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The Value of the Fermentation Test for Sugar in the Urine.—H. A. CHRISTIAN (*Boston Med. and Surg. Jour.*, 1907, elvii, 178) discusses the fermentation specific gravity test for quantitative sugar estimations in diabetic urine. Roberts in 1861 described a method of determining the presence of glucose in diabetic urine by means of the decrease in its specific gravity following the action of yeast. In comparing his results with the other methods in vogue at this time he was convinced of their accuracy. Of late this method has been neglected for other quantitative tests, such as titration with some form of copper sulphate, polariscopic examinations, and fermentation methods. The fermentation test has been compared with Fehling's and the polariscopic methods during the last two years at the Massachusetts General Hospital, and the results, graphically charted, show how closely the readings of the three methods agree. The procedure is as follows: Take the specific gravity of the urine at the room temperature; add a small bit of commercial yeast and place in a warm spot such as an incubator at 37° C., or in a heated room near a stove or radiator. When the bubbles of gas cease to appear, the urine should be tested with Fehling's or Nylander's solution, a negative result showing that the fermentation is at an end (usually twelve to thirteen hours). The specimen is then allowed to return in the room to the temperature of the previous specific gravity determination, and the specific gravity is redetermined. The difference between these two readings multiplied by 0.23 gives the percentage of fermenting substance expressed in terms of glucose. Filtering the urine before the second specific gravity determination gave no appreciable difference. Ordinary good commercial specific gravity bulbs were used and their results compared with more accurate ones; calculating the necessary allowance for temperature changes, the differences between the two were very slight. The same bulb, however,

ner of speaking and breathing of the patient. Billings' conclusions are as follows: It seems probable that the relative intensity of the breath and voice sounds over the upper and lower portion of the upper right lobe of the lungs remains about the same in health, being about 5 to 4 or 5 to 3; that when the sounds at the apex are physiologically intensified there is a corresponding intensification of the sounds over the rest of the upper lobe, the ratio being the same as in normal chests, namely, 5 to 4 or 5 to 3. In incipient tuberculosis with beginning infiltrations of the right apex the signs here are intensified, while those over the rest of the upper lobe remain normal. The ratio between them is thus distinctly increased to 2 to 1 or even higher. An increase in these ratios to 2 to 1 or over suggests the presence of infiltration, possibly tuberculous, at the apex of the right lung.

Blood Pressure as a Guide in the Treatment of Hemoptysis.—EDWARD O. OTIS (*Boston Med. and Surg. Jour.*, 1907, clvii, 211) considers the varied opinions as to the value of drugs in the treatment of hemoptysis. The ordinary routine treatment of rest, ice, morphine, etc., yields good results in most cases. The efficacy of nitrite of amyl and the nitrites in those cases with a high blood pressure led Otis to test the action of ergot, especially in those cases of low blood pressure or when recurrent and continued slow bleeding might indicate a passive rather than an active hemorrhage. After a large number of blood-pressure determinations by the Janeway instrument the average obtained was found to be about 126 mm. of mercury for tuberculous patients. In those cases upon which the report is based the pressure was between 109 and 119, having fallen from a higher point before the hemorrhage. The estimation of the pressure can be of much use only when routine examinations are made in order that any fall in the blood pressure before hemorrhage may be noted. As a result of his studies Otis concludes that in the treatment of hemoptysis the essential factors are, (1) a thorough knowledge of the blood pressure from previous observations; and (2) the usual routine measures of rest, ice, morphine, and atropine and, depending upon the amount and rapidity of the hemorrhage, inhalations of nitrite of amyl. In those cases of recurrent but persistent bleeding, if the blood pressure be high, use the nitrites, but, if low, ergotin subcutaneously. He says: "I am quite well aware that when I suggest the use of ergot I am uttering heretical doctrine, but in our experience it has apparently proved itself of value in at least a few cases when other remedies have failed."

the course of the clinical symptoms, as one may observe an increase of weight without manifest change in the general appearances. During the period of observation the two patients studied gained slightly in weight. They ascribe a nitrogen retention, observed in these cases, to the fact that the patients were steadily improving, were at rest, and, in one case at least, were taking abundant nourishment.

There was a slight diminution in the oxidative processes as revealed by the diminution in the amount of nitrogen in urea as compared to the total nitrogen. There was an increase in amido acids dependent apparently on altered conditions of the hepatic circulation in both patients. There was a slight increase in uric acid and in the nitrogen precipitated by the phosphotungstic chloride mixture. There was an increase in the earthy phosphates and a marked increase in the elimination by the feces of P_2O_5 , accounted for probably by the influence of the altered thyroid function as well as by the marked increase in the excretion of lime in the feces. There was an increased calcium elimination as well in the urine as in the feces and also an increased elimination of MgO by both urine and feces. They observe that, while they have been able to compare their data with those of other authors with regard to nitrogen, sulphur, and phosphorus, they have not been able to do the same in the case of the lime and calcium and magnesium. And from two cases alone they cannot draw positive conclusions. Repeated experiments through long periods of observation will be necessary to settle the significance of these observations with regard to the calcium and magnesium excretion.

In conclusion they say: "From all that which we have said the relation between the thyroid function and the alterations in the metabolism in Basedow's disease is clear; and the sharp difference between these alterations and those of myxœdema support strongly the thyroid theory of Basedow's disease." The authors also refer to the experiments of Kocher suggested by Scholz with relation to the treatment of this disease by phosphate of sodium, and suggest that in view of their observations it might be well to combine the administration of lime with that of phosphorus.

Auscultatory Ratios in Pulmonary Tuberculosis.—J. S. BILLINGS (*New York Med. Jour.*, 1907, lxxxvi, 10). In the examination of cases of incipient tuberculosis methods of distinguishing between beginning infiltrations of the apex of the right lung and simple physiological intensifications of the breath and voice sounds have been constantly sought for. In cases in which the abnormal signs at the apex seem to be due to a physiological intensification there is a corresponding increase over the lower part of the right upper lobe, both in front and back. In normal chests the same phenomenon at the apex and the lower part of the lobe is noted and a definite ratio of intensification is obtained. The sounds at the apex are of course louder than at the lower part of the lobe, this ratio in health being about 4 to 3 or 5 to 3. In order to record these differences the author used a modification of Oertel's stethoscope (which is illustrated) and examined the patient in a standing posture, listening at the apex of the lung in front and behind and also over the second space and the third rib, one and one-half inches from the sternum in front and just above the upper angle of the scapula behind. Much depends on the man-

in the testicle. Concerning the parenchymatous lesions of the testicles, Marcozzi says that there exists a certain degree of atrophy of the testicle, in consequence of which the albuginea is furrowed. The normal disposition of the cellular elements in the interior of the seminiferous tubules disappears; the testicular cells are intermixed in the wall of the canaliculi. In none of the preparations were spermatazoa or cells of Sertoli met with. The graver cellular changes concerned the spermatie cells, attacked by grave degeneration involving the protoplasm and nuclei. It was observed that even the protoplasm disappeared, leaving only the nuclei, also, changed. The detached protoplasm of the cells accumulated in the middle of the seminiferous tubules. In the nuclei are observed the phenomena which result from alteration in the form of the nuclei, a diminution of the chromic substance, a vacuolization, fragmentation of this substance, which can escape from the nucleus, thanks to the rupture of the membrane, and disappear. In the interior of the tubules are observed masses of protoplasm without nuclei, some polynuclear cells due probably to the division of the nuclei not followed by division of the protoplasm, which not only does not divide, but which progresses to degeneration. In the seminiferous tubules of the testicle and especially of the epididymis, one observes some testicular cells in process of disintegration, in different degrees of degeneration. The wall of the tubule and some of the testicular cells may be detached, and these cells may be eliminated through the tubules at the same time as the spermatie fluid. There are observed, also, some changes in the spermatazoa which, in general, appear in the form of small rods, not having attained the last degree of their development, and presenting some of the residue of the protoplasm of the spermatie cells from which they were derived. There are recognized, also, changes in the heads of certain spermatozoa. Their heads are enormously increased in volume, their tails short, so that they resemble a small nail. Finally, there are some lesions of the intercanalicular connective tissue, which appears atrophied, formed of very rare and delicate fibrils, with small cell infiltration, denoting a certain degree of inflammation, and with large nuclei changed in form or fragmented.

A Case of Polycystic Disease of the Kidneys.—BARRINA and PASCUAL (*Annales des maladies des organes genito-urinaires*, 1907, xxv, 10) say that the diagnosis of polycystic disease of the kidneys is possible and easy, and with modern methods of renal exploration, we ought always to make it. A polycystic kidney can be the seat of other affections, as lithiasis, tuberculous, etc. Retention with distention of the pelvis can occur in the absence of any other obstacle to the free passage of urine. In all of the author's cases the renal polycystic disease was associated with a true fibro-epithelial tumor, because the connective tissue and epithelium are developed in equivalent proportions, as shown by the microscopic preparations. The progressive development and indefiniteness of the disease contribute likewise to give to it the characteristics of the tumor. In their cases as in many others, a certain connection can be established between the polycystic kidney of infancy and that of the adult. It seems, therefore, that the congenital origin of the disease is more and more confirmed. As to the etiology of the disease, the authors believe that it should be sought

S U R G E R Y.

UNDER THE CHARGE OF

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Cancer of the Breast and its Operative Permanent Cure.—FINSTERER (*Deut. Ztschr. f. Chir.*, 1907, lxxxix, 143) says that of the cancers of the breast operated on from 1877 to 1903, there was 12.5 per cent. of permanent cures; in the last eight years the percentage increased to 24.64. The extent of the operation was always made to depend upon the local findings. The best method of operation is that which diminishes as well the number of local recurrences, as by the most exact removal of lymph glands it diminishes the occurrence of metastases. An extensive removal of the overlying skin should receive close attention. The supraclavicular fossa should be cleaned out in every case, and absolutely so, when during the operation the infraclavicular glands are found to be diseased or are considered to be suspicious. The question as to whether in the presence of demonstrable disease of the supraclavicular glands, an operation is or is not justified, needs more exact examination. Cases are known which contradict the rule of simultaneous involvement of the supraclavicular and intrathoracic glands and pleura. To decide some cases, one must take into consideration the duration of the disease, the size and situation of the tumor (whether it involves the inner or the outer half of the mamma), the size and possible growth of the supraclavicular glands. On account of the frequency of late recurrences, the time limit of permanent cure should be increased to five years, and for the determination of the results, the ability of the patient to work should be taken into account.

The Actions of the Poisons of Tuberculosis upon the Parenchyma of the Testicle.—MARCOZZI (*Annales des maladies des organes genito-urinaires*, 1907, xxv, 974) says that while the tissues involved by the presence of the tubercle bacilli are the seat of the production of tubercles and necrosis, the poisons of these same bacilli carried in the blood which dilutes them have no necrosing action on the tissues. They do, however, disturb the nutrition and functions of the tissues, producing inflammatory phenomena more or less grave, which are soon followed by different varieties of the process of degeneration. This action of the poisons manifests itself clinically by a considerable diminution of the vitality of the cellular elements, and it explains the tuberculous cachexia. In the liver it may cause a form of cirrhosis, in the kidney a parenchymatous nephritis with grave changes in the renal epithelium, and lesions

intestine may be found of a reddish-black color or even gangrenous. The hernial ring is seen not to be constricting the intestine and the cause must be sought higher up in the abdomen. If there is, also, a true strangulation at the neck of the sac this can be relieved in the ordinary way, but if on examination of the intestine it is seen that the strangulation extends higher, the intestine is drawn out until the seat of the trouble is found, extending the original herniotomy incision. An additional median incision is to be preferred. The herniotomy wound is to be closed or not according to whether the condition of the contained intestine will permit it or not.

THERAPEUTICS.

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The Serum Therapy of Bacillary Dysentery.—VAILLARD and DORTER (*Revue de therap.*, 1907, x, 331) consider that antidysenteric serum injected in doses adapted to the patient in hand will relieve the intestinal disturbances of mucous colitis almost immediately and ensure a rapid recovery. The action of the serum is most prompt and effective when it is administered early in the disease. It is also effectual late in the affection, arresting the progress of the infection and hastening cure. In fine, antidysenteric serum is the specific agent in the treatment of bacillary dysentery, and in this disease has an effect analogous to that of antitoxin in diphtheria; its universal employment will reduce the mortality from dysentery to a minimum. By its administration the symptoms become rapidly ameliorated and a prompt cure is brought about. As a prophylactic its use is important and, especially in epidemics, it should be given as a routine. The above conclusions are the result of an extensive study of patients treated by the serum. The dosage in mild infections is from 5 to 7½ drams, but in grave instances of the affection it may be necessary to inject as much as 2½ ounces and to repeat the dose on the day following. As the treatment shows its good effect and the defecations become fewer, the injections may be continued, but the dosage should be gradually diminished.

The Hydrotherapeutics of Mucous Colitis.—WILSON (*Edin. Med. Jour.*, 1907, xxii, 45) states that the use of balneotherapeutic measures for the treatment of mucous colitis is attended with excellent results, often after the usual methods have met with little or no success. The baths consist of two parts, which may be given together or separately as the

in the embryological development, separately, of one group of embryological epithelial and connective-tissue cells.

Surgical Anatomy of the Hyo-thyro-epiglottic Region.—POIRER and PICQUE (*Revue de chirurgie*, 1907, xxvii, 1) say that the hyothyroid region deserves attention because it is the path of access to the hyothyro-epiglottic region. The bursa of Boyer, which lies between the thyrohyoid ligament and subhyoid muscles, and aids in the movements of the larynx, is far from being constant. It is often represented by a poorly differentiated cellular tissue. The thyrohyoid membrane is made up of a resistant median portion and two thin membranous lateral portions. The epiglottis is connected to the larynx and to the tongue by a true crucial ligament represented in the horizontal plane by the hyo-epiglottic membrane, forming a continuous plane between hyoid and epiglottis; and in the sagittal plane by the median glosso-epiglottic ligament, which below the hyo-epiglottic membrane is attached to the hyo-glossus. The fossa described by Brousses and Brault, as the glosso-thyro-epiglottic fossa, between the thyrohyoid membrane and the epiglottis, is in reality limited to the hyo-epiglottic membrane which closes it constantly and completely above. It, therefore, deserves the name, hyo-thyro-epiglottic fossa. A subhyoid sagittal section always divides it completely into two lateral compartments, each of which represents a triangular prism, the apex being below and the base above. Each one of them contains a fringe of fat, which aids in the free epiglottic movements. It is in these fossæ that the phlegmon of Brousses and Brault develop, the identity of which, however, is yet to be demonstrated. The transverse incision of Malgaigne, large and early, is considered to be the treatment for it. In case it progresses toward the base of the tongue, the transverse incision of Vallas, will permit a wide exposure for view.

Volvulus of the Small Intestine and of the Initial Portion of the Large Intestine.—GUIBE (*Revue de chirurgie*, 1907, xxvii, 91) says that cases of volvulus of the small intestine ought to be operated on soon. Leichenstern has claimed that the intestinal twist can undo itself; but those who have seen these cases know that nothing is less likely. They are always very tightly locked. To attempt to bring about an untwisting would lead to a fatal termination by a failure to undo the twist or by rupturing the intestine. Laparotomy should be done and it should be sufficiently large to explore conveniently the abdomen and the lesions, and to permit one to undo the volvulus. Recognition of the lesion is easy enough when the volvulus only involves a small loop of intestine; when it is a little long and the intestine above is distended, it can be very difficult of recognition. When recognized it should be emptied by puncture or enterotomy. With the emptying of the involved intestine, the untwisting results at the same time. If the condition of the intestine calls for resection the prognosis is very bad. Sometimes the volvulus begins with the signs of a strangulated hernia and then the diagnosis is not easy. In such cases the operation is usually begun as a herniotomy. If the volvulus and strangulation are in the hernial sac the diagnosis is easy as soon as the sac is opened. The diagnosis is not so easy when the sac contains only a part of the twisted intestine. On opening the sac the

to all patients, even those who received antitoxin during the acuity of the disease. He employed this treatment in thirteen patients, all of whom were cured.

Opsonic Therapy in Skin Diseases.—VARNEY (*Jour. Amer. Med. Assoc.*, 1907, xlix, 316) concludes a report upon a series of patients affected with acne, furunculosis, sycosis, and whom he has subjected to vaccine treatment, with the following statements: In bacterial inoculations we possess a therapeutic agent with a specificity of great merit. Wright's method of obtaining the resisting power of a patient is also of unquestionable value as a guide to determine what will raise the resistance. Vaccines made from the patient's own invading micro-organisms produce better results than stock vaccines. These results may be obtained with or without opsonic readings, but they will be better if controlled by frequent estimation of the patient's resistance. Proper vaccination, administered in appropriate doses and when the opsonic index indicates the necessity, is an efficient treatment of certain chronic local infections.

Vaccines in Surgical Therapy.—BERGEY (*Univ. Penn. Med. Bull.*, 1907, xx, 50) states that bacterial vaccines may be employed as protective agents in surgery when it is evident that proper asepsis is impossible, and in patients of lowered vitality when the probability of secondary pyogenic infection is evident. In operations about the mouth, for instance, when it is impossible to control secondary infection, it is advisable to subject the patient to pre-operative inoculations so as to increase his opsonic index for staphylococci and streptococci. In diabetics and albuminurics, when the general vitality is low, it is believed that the success of surgical procedures can be increased by first raising the subject's opsonic index for the common pyogenic bacteria. Similarly secondary infection of tuberculous abscesses may be avoided. The use of the vaccines seems clearly indicated in accident wounds when asepsis is doubtful and when mutilation of tissues renders secondary infection probable.

Nuclein in the Prophylaxis and Treatment of Peritoneal Infections.—CHANTEMESSE and KAHN (*Klin.-ther. Woch.*, 1907, xiv, 663) advise the employment of hypodermatic injections of the sodium salt of nucleinic acid in the prevention and treatment of peritonitis, on the ground that this substance has the property of increasing the number of leukocytes in the circulating blood, and thus increases the bodily powers of resistance to infection. Experimentation in man as well as in animals shows that after the injection of this substance a mononuclear leukocytosis takes place which reaches its height in about forty-eight hours and lasts from four to five days. An injection of 6 grains of sodium nucleinate in about 10 drams of sterile salt solution into the flank or into the fleshy part of the thigh may be painful and is likely to be followed in twenty-four hours by the signs of inflammation; these soon disappear. The injection may be repeated two or three days later and as many as three injections may be given in a single day. The leukocytes may thus be increased to twice or three times their normal number. In one patient with intestinal perforation who was treated by the nuclein

physician may direct: (1) The intestinal douche; this is administered while the patient lies on a special couch. A rectal tube is passed high into the bowel and the prescribed amount of hot mineral water is allowed to flow, under carefully regulated pressure, into the intestine. While the water is retained the patient's position is changed; the bowel is later emptied and the process is repeated. (2) The Tivoli douche; this consists of an ordinary reclining bath, in which the patient lies covered, except for the head and neck, in warm mineral water. While so lying a hot-wave douche is played on the abdomen; this latter is usually of a much higher temperature than that of the bath. These methods are carried out in conjunction with special dieting and the drinking of mineral waters. The technique described is that employed at the springs of Harrogate, England.

The Treatment of Itching.—BULKLEY (*Jour. Amer. Med. Assoc.*, 1907, xlix, 321) divides the useful external applications into two types, the soothing and the analgesic. Of the former he suggests the following formulæ: *R.*—Phenol, ʒss–ʒj; pulv. calaminæ prep., ʒj; zinci oxidi, ʒij; glycerin, ʒiij; aq. calcis, ʒj; aq. rosæ, q.s. ad ʒiv. *Sig.*—To be sopped on repeatedly. *R.*—Pieis liquidæ, ʒiv; potassii causticæ, ʒij; aquæ, ʒx. *Sig.*—Dilute one to ten or twenty with water and bathe the surface, applying a suitable ointment afterward. Ichthyol in ointments or in 10 to 25 per cent. solution in water or oil is often useful. For mild general pruritus the following ointment may be prescribed: Phenol, 20 to 40 grains; lanolin, 1 ounce; boroglycerin, 4 drams; ung. aq. rosæ, 3 ounces. One-half to one dram each of camphor and hydrated chloral rubbed up with lanolin to an ounce is an efficient antipruritic, but it is irritating to the broken skin. Many skins do better without greasy applications, and the glycerite of starch may be substituted in the above ointments for the fatty base. Tar, oil of eade, and oil of birch are also valuable and harmless antipruritics.

The Treatment of Delirium Tremens.—EICHELBURG (*Münch. med. Woch.*, 1907, xx, 978) believes in the immediate suppression of alcohol in delirium tremens and in the employment of hydrotherapeutic measures rather than of hypnotics; the former serve to increase and to maintain the activity of the heart, although one would expect an opposite effect. In instances of cardiac weakness stimulants, strophanthus, digitalis, camphor, caffeine, are employed, and in about three days, when the delirium begins to lessen, 30 to 60 grains of chloralformamide are given; this quickly induces sleep. Thirst is controlled by bitter infusions. If pneumonia appears as a complication, digitalis and alcohol are administered. In these patients the prognosis is distinctly bad.

The Treatment of Diphtheritic Paralysis.—COMBY (*Bulletin méd.*, 1907, xxxviii, 442) considers that every patient, old or young, affected with diphtheritic paralysis, light or severe, recent or of long standing, localized or general, should immediately receive injections of antidiphtheritic serum. These should be repeated daily for from three to six days, depending on the severity of the affection. The dose employed should be from 150 to 300 minims of Roux's serum. Such dosage is followed by no unpleasant effects and should be administered

is less contagious than measles and probably equal to that of scarlatina; its period of transmissibility is from two to three weeks. The period of incubation is from one to three weeks. Prodromas are often wanting, the first symptom being frequently the rash itself. Febrile symptoms may precede the rash by from six to twenty-four hours. Initial vomiting is exceptional. Mild catarrhal symptoms with hyperemia of the mucous membranes of throat, mouth, or eyes are occasionally present. The eruption appears first on the face, spreads to the neck, and then rapidly downward, involving the trunk and portions of the extremities in a few hours. It is especially pronounced over areas covered by clothing and does not pick out the flexor surfaces. Fine points may first appear, quickly blending into a general hyperemia; small patches of normal skin with irregular margins are visible here and there. The oronasal pallor of scarlatina is absent. The rash fades rapidly after two to three days without stain, which is often observed in rubella and measles. There is no itching and the skin does not feel hot. Desquamation of a fine and branny character usually follows the disappearance of the exanthem. The fever subsides with the eruption. The tongue is negative beyond an occasional coating, the throat, beyond an occasional hyperemia; the pulse is in proportion to the fever. The postcervical and occipital lymph glands may be enlarged in the early part of the attack; massive enlargements are only seen in complicated cases. Sequels and complications rarely occur, the course being usually mild and uneventful. It is differentiated from scarlet fever by (1) its long period of incubation; (2) absence of initial vomiting; (3) moderate fever of brief duration; (4) normal ratio of pulse to temperature; (5) absence of characteristic scarlatinal tongue; (6) absence of, or, if present, the fine character of, the desquamation; (7) the freedom of sequels; (8) probably the absence of leukocytosis.

The Prevention of Ophthalmia of Infancy.—L. HOWE (*Virginia Medical Semi-Monthly*, 1907, xii, 265) points out that more blindness is caused by ophthalmia neonatorum than by any other disease and that a 2 per cent. solution of silver nitrate is the most reliable prophylactic. He emphasizes the necessity of a law in all States which makes necessary an immediate report of all infants in whom one or both eyes become inflamed, swollen, or reddened at any time within two weeks after their birth; and if laws were passed to make the employment of Credé's method compulsory, it would be a still greater boon to the human race.

The Purpura of Children.—H. R. DEAN (*Brit. Med. Jour.*, 1907, ii, 815) has studied 52 cases of primary purpura during the last ten years and has found them all to be of one type with differences in degree of severity. Some, because of their mildness, had to be classed as purpura simplex; but even they presented some intestinal derangement and joint disturbance. In some of the cases a predominance of arthritic changes was noted, but in none of these could a history of rheumatic fever be obtained. The joints are not so hot as in rheumatism; a predominant feature is a general oedema of the shin and foot, while the joint disturbance is not so obvious; the temperature chart of the two diseases differs; profuse sweats are absent in purpura and cardiac complications are almost unknown. Gastro-intestinal symptoms, such as sudden violent

injections, the opsonic index was increased from 1.6 to 2.5 twenty-four hours after these had been undertaken. Chantemesse and Kahn cite patients suffering from enteric fever in whom all the signs of intestinal perforation were present and in whom all these manifestations disappeared after the nuclein injections. It is possible that in these patients a small intestinal perforation may have been present, but it is difficult to be sure of this. The treatment is recommended in enteric fever with symptoms of perforation or peritonitis; it is suggested that it may give benefit in such conditions as pneumonia and erysipelas, and that it may be employed in the prophylaxis of operative peritonitis.

Formic Acid in Diphtheria.—KER and CROOM (*Edin. Med. Jour.*, 1907, vi, 487) have employed formic acid in 412 patients during 1906 at the Edinburgh City Hospital, with the result of diminishing the death rate by 1.8 per cent. over that of the previous year. Previously strychnine had been given as a heart tonic, but during 1906 formic acid in 25 per cent. aqueous solution, in doses of 5 to 20 minims every four hours, was substituted, the dosage being graduated rather by the severity of the infection than by the age of the patient. No change in the heart action was noted until after about forty-eight hours, and then the change was rather a negative one, that is to say, many of the severe infections did not show the expected cardiac weakness and irregularity; on the other hand, the pulse in many instances was much improved in character, as was the color of the skin and the general nutrition. Patients were observed who appeared doomed to die of heart-failure, but who rallied, this manifestation being attributable to the possible limiting effect of the formic acid upon the degeneration of the heart muscle or its beneficial action upon the undamaged muscular tissue. The most striking result of the treatment was the diminution of the number of instances of paralysis, the percentage being only 2.9, as against 9.09 in the previous year, which was the lowest in several years. If this diminution of the paralysis is really due to the formic acid, the point is raised why a muscular tonic should have such a result on a lesion usually regarded as primarily of nervous origin, although it is true that post-diphtheritic muscular weakness is rather a paresis than a complete paralysis. They conclude that the results obtained are distinctly encouraging, particularly in relation to the occurrence of cardiac failure and paralysis. Formic acid is, at least, an admirable tonic; it is safe and may be employed to the advantage of the patient.

PEDIATRICS.

UNDER THE CHARGE OF

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Scarlatina and Duke's Disease.—A. C. COTTON (*Jour. Amer. Med. Assoc.*, 1907, xlix, 1417) believes in the entity of the fourth, or Duke's disease. He summarizes its clinical features as follows: The disease

most cases a nasal discharge. Examination of the throat nearly always makes the diagnosis apparent, and particularly if digital examination is used. The finger should be used very gently, however, for fear of rupturing the abscess. If diagnosed early the prognosis is usually good; if undiagnosed the abscess ultimately discharges into the throat and septic bronchopneumonia terminates the case. A large incision through the pharyngeal wall is preferable to other routes of operation. The author closes by stating that the condition is very frequently overlooked, possibly more often than any acute condition of childhood, owing to the variability and multiplicity of the signs and symptoms accompanying it. If the pharynx is examined the diagnosis is made in every case.

Prolapse of the Rectum in Children.—P. L. MUMMERY (*Brit. Med. Jour.*, 1907, ii, 812) states that rectal prolapse is a comparatively common affection among children. Of 50 consecutive cases he has found 22 to be among males, 28 among females; their ages varied from three months to five years. Of causes diarrhoea was the commonest precursor of prolapse, occurring in 14 of the cases; 13 of the patients had adenoids; 3 had worms; in 3 the condition followed whooping-cough and in 3, measles; 2 had rectal polyps, 1 prostatic inflammation, and 1 a rectal stricture; in 1 case it was blamed on constipation; stone in the bladder or phymosis was not present in any of the cases. General weakness and malnutrition, therefore, caused the larger number, local causes being present in but 7. Absorption of fat is a result of malnutrition, and the removal of this fat from the rectum predisposes to prolapse. The exciting cause he considers to be the unnatural method of defecation adopted in civilized countries. Pathological prolapse is unknown among animals and uncivilized races. The natural position for defecation is the squatting one, in which the glutei and perineal muscles are firmly contracted, thus supporting the levator ani and tightening the pelvic fascia; the coccyx is firmly fixed in the squatting position, the lower part of the rectum thus forming a considerable angle, while in the sitting posture the rectum is almost a straight tube. The obliquity of the false pelvis in children also predisposes to prolapse. In treatment the child's general health and nutrition must be improved. The stools should be passed in the squatting position into a shallow pan. This cures prolapse as a rule at once. Local causes, whether rectal or otherwise, must be attended to.

OBSTETRICS.

UNDER THE CHARGE OF

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Valvular Disease of the Heart Complicating Pregnancy.—NEWELL (*Surg., Gyn., and Obstet.*, May, 1907) contributes a paper upon valvular diseases of the heart complicating pregnancy, reporting 3 cases.

pain, vomiting, bloody diarrhoea, are extremely common, and may precede the purpuric rash for some days or even weeks. In purpura the lymphocytes are often increased; otherwise the blood picture is that of sudden and severe hemorrhage. Hematuria was noted seven times, and albuminuria without hematuria twice; hematuria may persist for weeks. In some instances the renal symptoms are sufficiently severe to permit of a diagnosis of acute renal disturbance. In 1 case the symptoms of renal calculus were simulated. Hematemesis occurs only occasionally; in 2 cases the symptoms pointed to intracranial hemorrhage, possibly meningeal; in 1 there was effusion of blood into the pleural cavity. Hemorrhage into the buccal mucous membrane and conjunctiva, as well as epistaxis, are seen occasionally; retinal hemorrhage is rare. One-third of the patients have enlargement of the liver; the spleen is but rarely enlarged. Dean believes purpura to be the result of some undiscovered infective or toxic process. A very characteristic condition is to be found in the recurrence of the purpuric symptoms at irregular intervals for several weeks or even months. Through 4 cases of the series the close relationship of purpura with hemophilia is pointed out; but in all 4 the history of hemorrhage was on the father's and not, as in hemophilia, on the mother's side.

Case of Cerebral Hernia in a Boy.—E. F. TALBOTT (*Jour. Amer. Med. Assoc.*, 1907, xlix, 1441) reports the case of a boy, aged sixteen years, who as a result of a gunshot wound in the head had a paralysis of the right arm and leg, and of the bladder and rectum. There were two openings to the left of the crown of the head about one and one-half inches apart. A depressed portion of the inner table was removed, together with several spicules of bone, and the wound was closed with drainage. Pressure symptoms necessitated reopening of the wound; a hernia resulted, but the pressure symptoms were relieved. A sinus leading into the brain discharged pus for a month, when a small piece of bullet was found in its bottom; its removal caused diminution in the discharge of pus, but an increase in the size of the hernia. The hernia had to be cut away because of pressure symptoms, but later reappeared larger than before. Five months after the injury an abscess was located and drained; later still the hernia had again to be removed, when a second abscess which led well into the substance of the brain was opened and drained. Since then the wound has entirely healed, the boy enjoying good health physically and being well mentally. The bladder and bowels have recovered, but the forearm and leg are still paralyzed.

Retropharyngeal Abscess.—H. I. PINCHES (*Brit. Med. Jour.*, 1907, ii, 813) includes collections of pus at the back and side of the pharynx under this heading. He differentiates between the acute and chronic, the non-tuberculous and tuberculous. Most of the acute abscesses occur during the first twelve months of life; the children as a rule have been perfectly well and strong. In most cases the condition is preceded by some inflammatory affection of the tonsil or some of the lymphoid tissue of the neighborhood; enlarged tonsils and adenoids are present in almost every case of retropharyngeal abscess. The symptoms are: difficulty in swallowing and breathing; the child is always very ill, having high fever, a rigid neck, a retracted head, a peculiar cry, and in

the operation and reacted, but collapsed and died in four or five hours without hemorrhage. Here again, while the patient's compensation carried her through pregnancy, forty-eight hours of labor was more than the heart could endure.

Newell concludes that an organic heart lesion in a pregnant woman calls for constant watchfulness, and should compensation begin to fail at any time in pregnancy an attempt should be made to restore compensation by rest and tonics, but unless these measures are promptly successful, pregnancy must be interrupted. In all such cases labor must be made as brief as possible, and terminate promptly in the interest of the mother.

Tubal Gestation with Continued Growth of the Fœtus after an Hematocele had Developed.—FAIRBAIRN (*Jour. Obstet. and Gyn. Brit. Empire*, December, 1906) reports a very interesting case in which a patient had typical signs of ruptured ectopic gestation. Her pain grew gradually better and hemorrhage ceased, but returned profusely. On examination, the uterus was slightly distended and so rigid and tender that it was very difficult to make out the position of the womb. Upon operation the omentum and underlying viscera were matted together by adhesions, suggesting a condition of inflammation. There was yellow lymph among the adhesions, and a dirty, almost purulent fluid escaped from the abdomen. After separating the adhesions the swelling was found to be the left Fallopian tube with an hematocele sac. During the removal of the mass the sac ruptured, followed by the discharge of the fœtus, placental tissue, and blood clot. The cavity in the pelvis was drained by gauze, and the patient made a good recovery. Upon examination of the specimen, abundant evidence was found that the embryo had continued to develop after rupture of the old sac, with formation of a pelvic hematocele.

Acute Salpingitis Complicating Tubal Gestation.—EDEN (*Jour. Obstet. and Gyn. Brit. Empire*, December, 1906) reports the interesting case of a woman with tubal gestation, complicated with acute salpingitis. Upon opening the abdomen, omentum and coils of small intestine were found adherent to a pelvic tumor. This was gradually isolated and its pedicle traced to the right broad ligament. The pedicle was clamped, and the tumor removed. There were many adhesions, recent and very vascular, and oozing from the bed of the tumor was arrested by packing. The left uterine appendages were found to be practically normal. The patient made a good recovery. Upon examining the specimen, the gravid Fallopian tube was also the site of an acute salpingitis. It is difficult to understand how the ovum can implant itself upon the mucous membrane of a tube in a state of acute inflammation. The most rational explanation is found in the fact that conception and infection must have occurred at about the same time.

Ruptured Ectopic Gestation Following the Alexander Operation.—BATCHELOR, (*Jour. Obstet. and Gyn. Brit. Empire*, December, 1906.) reports 4 cases of ruptured ectopic gestation occurring in patients upon whom had been performed the Alexander operation. It seems difficult to trace the cause of relationship between the ectopic gestation and the Alexander operation.

The first was a multipara six and a half months advanced in the sixth pregnancy. Compensation began to fail ten months before admission to the hospital. Upon the advent of pregnancy the symptoms grew progressively worse. On admission the patient was anemic, with labored breathing, moderate œdema of the lungs, œdema of the extremities and abdominal wall. The heart was much enlarged, with diffuse pulsation over the apex; the heart rate 140, pulse 112. A loud, systolic murmur was heard over the entire chest. The uterus extended three fingers' breadth above the umbilicus; the child was evidently not large. The abdominal cavity contained some free fluid. The patient's condition was so bad that immediate operation seemed excessively dangerous. Accordingly, delay was practised to secure a better condition. As the delay resulted in but very slight and transient improvement, the patient was given ether, the uterus dilated, and the child delivered by version. Death occurred before the completion of the operation, which occupied but sixteen minutes. A small, living child, weighing two and a half pounds was born, but died in a few hours. During the six and a half months of her pregnancy this patient had been under the care of eight different physicians, who had attempted to stimulate the heart and secure compensation, not realizing that the added strain of pregnancy made radical improvement impossible. Had pregnancy been interrupted at an early stage the patient's life might have been indefinitely prolonged.

The second case was that of a primipara, with enlarged heart, slight cyanosis, marked dyspnoea, and slight pulmonary œdema. This patient had a presystolic murmur, with marked thrill over the apex. With rest, digitalis, and strychnine, the patient improved, compensation being reëstablished, and the patient passed comfortably through the remainder of her pregnancy to full term. The patient passed through her first stage of labor with comparative comfort, and the perineum softened to some extent. Collapse, however, developed, the patient became very cyanotic, œdema of the lungs developed, and the pulse rose to 160. The child was immediately delivered by forceps, and the patient was greatly relieved by moderate bleeding. She made a fair recovery. Although the patient apparently did well in labor, her final collapse showed that her favorable progress was apparent only, and that interference should have been undertaken earlier.

The third patient was a primipara, aged thirty-five years, with a history of rheumatism, endocarditis, and aortic insufficiency. She passed through pregnancy fairly well, and was seen in consultation after forty-eight hours of moderate labor. Morphine had been given to lessen the patient's suffering. The patient was well developed and well nourished. The heart was greatly enlarged, with a loud systolic murmur over the aortic region. The radial pulse was poor. The uterus was rigidly contracted about the child, with a contraction ring palpable at the child's neck. The foetal heart was 160. On vaginal examination the lower segment was greatly thinned; the os was dilated to about one-half inch with a wire edge. The cervix was tightly applied over the child's head. Engagement was present. Under ether the cervix was dilated manually, the occiput rotated in front, and the child extracted by forceps. The child was living at birth, but died in five or six hours. The mother was in a fairly good condition at the end of

the canal was constricted abruptly with very thin and soft walls. It was impervious; distal to this the tube was enlarged to the size of a walnut and contained sebaceous matter.

For a distance of 3 cm., beginning 2.5 cm. from the uterus, the right tube was much thinned and impervious; in fact, macroscopically no trace of the tube could here be found. Beyond this portion it seemed normal. A small fibroid was found in the uterine wall in the cornu just behind the tubal insertion. The possibility, even the probability, of a former salpingitis is to be suspected, both from the findings and the severe pain the patient had experienced. That a developmental abnormality antedated and had a causative effect upon the inflammation cannot be successfully disputed.

These possibilities are also illustrated in a case of congenital atresia of the left tube reported by Lejars (*ibid.*). The right appendage of a girl, aged seventeen years, was a pus tube and an ovarian cyst, both of which were adherent to the omentum and to the uterine fundus. The left tube, ovary, and border of the uterus from the cervix to the cornu had the appearance of a bridle or band of tissue attached to the cervix at one end and at the other to the wall of the pelvis, well separated from the fundus. The structure was fibrous and ended in a small pavilion near which was a very small microcystic ovary. Microscopic study of the tube showed it to be impermeable except for a very short distance at the fimbriated end. This tube was clearly one the development of which had been arrested early in foetal life, the cord-like body evidently being the part of the left Müllerian duct that forms the Fallopian tube and left half of the uterine body.

The Diagnosis and Treatment of Genito-urinary Tuberculosis with Koch's Tuberculin.—R. BRINBAUM (*Zentralbl. f. Gynäk.*, 1907, xxxi, 1174) states that he has used Koch's tuberculin for diagnostic purposes in 100 cases, with satisfactory results, as judged by the subsequent history or operative procedure; 23 patients have been treated with either the new or the old tuberculin of Koch for such conditions as tuberculosis of the appendages and tuberculosis of the bladder with marked improvement or cures in many instances.

Migration into the Bladder of an Artery-clamp Left in the Abdominal Cavity.—W. STOECKEL (*Zentralbl. f. Gynäk.*, 1907, xxxi, 1105) says a laparotomy was performed upon a woman in October, 1906, and a hemostat evidently left in the abdomen. About eight months afterward the patient complained of pain upon miction, and vaginal and cystoscopic examinations revealed the presence of an instrument partly within the bladder. A colpocystotomy was performed and the instrument, which was found to lie in part in a walled-off abscess posterior to the bladder, was removed.

Perforation of the Uterus.—R. v. BRAUN-FERNWALD (*Zentralbl. f. Gynäk.*, 1907, xxxi, 1161) reviews the reported cases of perforation of the normal and the pathological uterus by the use of sounds, curettes, bougies, irrigators, forceps, and other instruments, and discusses the diagnosis and treatment of perforation. Mention is made of a case coming under his own observation in which the end of a glass catheter

Tubular Mole Removed During the Process of Operation—DORAN (*Jour. Obstet. and Gyn. Brit. Empire*, December, 1906) reports the case of a patient who came to the hospital complaining of abdominal pain. There had been a slight discharge of blood almost daily. Some time before coming to the hospital she had an attack of violent pain in the lumbar region, followed by painful micturition. Upon operation, the left appendages were bound down by adhesions, but were apparently healthy, the Fallopian tube being unobstructed. The adhesions were freed and the tube allowed to remain. The mass in the pelvis proved to be the distended right Fallopian tube, which was removed with the ovary. Upon examining the specimen, it was found that tubal abortion was taking place.

Twin Pregnancy in a Fallopian Tube.—McCANN (*Jour. Obstet. and Gyn. Brit. Empire*, December, 1906) observed a tubal twin pregnancy. When seen the patient was exceedingly pale, unable to reply to questions, and with a very rapid and weak pulse. The lower abdomen was distended and sensitive, and a tumor was detected in the left iliac region. The uterus was slightly enlarged. The abdomen was opened, with a diagnosis of tubal pregnancy. The dilated left Fallopian tube and a mass of blood clot about it were removed. On examining the specimen in the dilated tube there was found a cavity occupied by two foetuses. They had separate umbilical cords and were unequal in size.

GYNECOLOGY.

UNDER THE CHARGE OF

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Congenital Atresia of Both Fallopian Tubes.—This is an extremely rare condition if one is to judge from the sparseness of the subject in literature and from a fairly large clinical experience. A case somewhat doubtful is reported by DOLERIS (*Ann. de gynec. et d'obstet.*, August, 1907, p. 465). The subject was twenty-eight years of age, large, well developed, of full habit, and in excellent health. Menses began at the age of fourteen years, was of an irregular type, painless, and without marked periods of real amenorrhœa. It lasted four days and was of a normal amount. She was married at the age of twenty-five years, when her menstruation became perfectly normal. She was sterile during this marriage. At the age of twenty-six years she was again married and now had some pelvic pain, at times severe. Eighteen months later she consulted Doleris for treatment of sterility. He found she had a normal-sized uterus that was retroverted, and appendages slightly enlarged and prolapsed. The tubes were non-adherent, as was the uterus. The muscular coats of the left tube were found to be thickened and hard near the uterus, but at 3.5 cm. from the uterus

None has been found in normal genital organs. The greater number have been isolated from cases of acute cervicitis with vaginitis and vulvitis. A few have been obtained from cases of chronic cervicitis. In a typical case of beginning mastitis the author found in the milk of the affected breast no organisms other than blastomycetes and these apparently belonging to one species. The infant nursed by this patient had a diarrhoea and in the stools were found the yeast cells. Several months later the same patient had an inflammation of the genital organs and in the secretions yeast cells were present in large numbers. Chronic gonorrhoea and pregnancy are believed to offer favorable conditions for blastomycetic infection. In the blood of a woman dying of puerperal sepsis and also in the lochia, Van de Velde found a large number of yeast cells in addition to bacteria. Other cases of a similar nature are mentioned. The results of the investigations are considered of sufficient importance to warrant further investigations, not only in regard to chronic endometritis, but other inflammatory conditions.

Statistics of Prolapse Operations.—J. SCHARPENACK (*Zentralbl. f. Gynäk.*, 1907, xxxi, 1073) discusses the results secured in 100 operations for prolapse by the Wertheim-Schauta method, in which a longitudinal incision is made in the anterior vaginal wall, the peritoneum separated from the cervix and bladder, the fundus pulled down through an opening in the uterovesical pouch and sutured to the edges of the vaginal incision, and the posterior surface of the uterus sewed to the posterior wall of the bladder. A plastic operation is also performed on the perineum. Of the 45 cases examined by Scharpenack eight months to three years and five months after the operation, perfect objective results were found to have been secured in 21 cases. A slight anterior prolapse was found upon strong bearing down in 16 cases and a slight posterior prolapse in 3. The results were unsatisfactory in 5 cases. Except in 2 cases, however, the patients were entirely satisfied. In 57 cases out of 72 favorable reports were made by the patients as regards subjective symptoms. In 4 cases improvement was admitted, but in 11 the symptoms were no better after the operation. Many of the reports were made by correspondence and not very much importance is attached to them. Those personally examined were, on the whole, extremely satisfactory. The operation is highly commended in preference to pessaries, especially when the tubes are cut, as was done in every instance by Scharpenack, and when the woman had passed the climacteric.

believed to have been used for producing criminal abortion was removed from an abscess in the abdominal cavity in the region of the sacrum.

Menstruation without Ovaries.—G. GELLHORN (*Zentralbl. f. Gynäk.*, 1907, xxxi, 1195) reports two cases. In the first the ovaries were removed in two operations separated by an interval of one year. Menstrual periods were regular and normal after the first operation. For several months after the second oöphorectomy they were of short duration, but gradually lengthened to three days and were, in all respects, normal. A third laparotomy was performed by Gellhorn, himself, seventeen months after the second operation. No trace of ovaries or tubes was found. The uterus was somewhat atrophied. Three bands connected the fundus of the uterus with the omentum. These adhesions were cut and menstruation ceased.

The second case was that of a woman, aged thirty-five years, who, six years previous to consulting Gellhorn had had the left adnexa removed. Her menstrual periods had been regular since her seventeenth year and of about five days' duration. Gellhorn's diagnosis—retroversion of the uterus, tumor of the right tube, perimetritis, and parametritis—was confirmed upon operation, at which the uterus was freed from all adhesions, the right adnexa removed, a ventral suspension of the uterus performed, and the appendix removed. The patient made a good recovery from the operation and was free from pain. Climacteric symptoms soon appeared, which were not satisfactorily controlled by bromide and other drugs. Gellhorn, therefore, administered ovarian substance in the form of 0.3 gram tablets three times daily, beginning January 17. On March 5 the patient had a bloody flow from the uterus, the source of which was ascertained by a speculum examination and which continued for five days. A second flow of the same character occurred on March 22. The ovarian tablets were then discontinued until April 17. Two days after resuming the treatment the third flow commenced. A fourth began May 1 and a fifth June 1. Treatment was then discontinued for six weeks and the flow did not appear during that time. Five days after resuming treatment a second time the flow reappeared. The most frequent cause of menstruation and even troublesome and irregular menstruation after ablation of the appendages is an infected endometrium or uterus, though many other causes are known. In Gellhorn's first case adhesions to the omentum were clearly proved to be the cause. His suggestion of extra blood supply is probably correct. In his second case ovarian substance seemed to have a causal relation that has not been referred to before.

Blastomycetes and Inflammations of the Female Genitalia.—VAN DE VELDE (*Zentralbl. f. Gynäk.*, 1907, xxxi, 1135) has made a study of the flora of the normal and diseased female genitalia and has in preparation a detailed account of his work. In this article attention is called briefly to some of the principal results obtained. In 77 instances the author has isolated blastomycetes from inflamed tissue, and in 24 of these cases the organisms have been grown in various artificial media. In the remainder of the 77 cases the yeasts have died out after a few generations, or their growth has been limited to special media. Of the 24 species carefully studied 13 have not hitherto been described.

The authors believe the histological changes which they have found prove that the Röntgen rays are able to destroy the specific cells of mycosis fungoides, and are, therefore, to be regarded as a specific curative agent in this disease. They believe that we now possess a method of treatment which, employed at the right time, often acts curatively, and makes possible a considerably more favorable prognosis.

Association of Erythematous Lupus and Tuberculous Lupus.—SPITZER (*Annales de dermat. et de syphiligraphie*, 1907, No. 3) reports the following case observed in Lang's clinic in the Vienna General Hospital: A man, aged thirty-seven years, was admitted to the hospital in January, 1900, having upon both cheeks plaques with a cicatricial appearance and slightly red and infiltrated border, and in places covered with very adherent scales. Here and there in the midst of the cicatrix were isolated or confluent nodules, undoubtedly the tubercles of lupus vulgaris. Four years before the patient had been admitted to Kaposi's clinic with a diagnosis of erythematous lupus, and had been treated with more or less success by applications of "gray plaster," salicylated plaster, curettement, and injections of arsenious acid. In addition to the lesions upon the skin the buccal mucous membrane presented grayish streaks extending from the labial commissures toward the pharynx, which were diagnosticated erythematous lupus. Microscopic examination of various parts of the disease confirmed the diagnosis of erythematous lupus associated with tuberculous lupus.

A Case of Xeroderma Pigmentosum Without Pigmentation.—AUDRY (*Annales de dermat. et de syphiligraphie*, 1907, No. 3) has observed a case of xeroderma pigmentosum which he reports in detail, in which there was practically absence of pigmentation, the only pigment anomaly being a few pale brownish and yellowish, freckle-like spots upon the backs of the hands. The patient was a man, twenty-four years old, who entered the hospital on account of an epithelioma of the lower lip which was regarded as inoperable by the surgeons, and referred to the dermatological clinic. Apart from the pigmentation the skin presented the usual features of this disease. It was thin, finely scaly, red, in places presenting a cicatricial aspect, and showed numerous stellar and punctate telangiectases. Microscopic examination of the skin revealed a diffuse atrophy of the epithelium, infiltration with lymphocytes, disappearance of the elastin, severe congestion, and fragmentation of the connective-tissue fibers in the superficial portions of the derma, and hypertrophy of the elastin in the deep layers. The epithelioma was of the spinocellular variety, and was accompanied by enlargement of the submaxillary glands. Under the influence of radiotherapy there was a notable diminution in its size and the glands became smaller and more movable. In the author's opinion this case proves that the atrophic condition of the skin is the one essential feature of this malady; all the other phenomena may be wanting, epithelioma being only a complication. In his opinion the malady ought to be classed among the congenital dyskeratoses.

DERMATOLOGY.

UNDER THE CHARGE OF

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The Relationship Between Diseases of the Skin and of the Kidneys.—GLASERFELD (*Dermatologische Zeitschrift*, Band xii, Heft 10) after a careful study of the literature of diseases of the skin and kidneys as to their association with one another, concludes that only in inflammations and disturbances of the circulation of the skin, do affections of the kidneys occur which are dependent upon the former. Such are almost always found in impetigo herpetiformis, and often in erythema, urticaria, acute circumscribed oedema, Raynaud's disease, purpura, eczema, and acute pemphigus. The kidney symptoms appear during the existence of the skin affection, or immediately after it. They are usually of a harmless character; but in eczema and purpura the prognosis of the nephritis may become more serious. Progressive and regressive disturbances of the nutrition of the skin, infectious diseases, and parasitic dermatoses were never observed to be produced by nephritis; with the exception of pruritus, it was only disturbances of the circulation and inflammations of the skin which were noted. Acute nephritis predisposes very little to complications on the part of the skin. The several forms of chronic nephritis vary little as to their liability to be followed by affections of the skin. The latter appear only after disease of the kidneys has lasted for some time, and are very difficult to cure, improvement only appearing with the adoption of a therapy suited to the kidney affection.

The Histology and Roentgen Therapy of Mycosis Fungoides.—HERXHEIMER and HUBNER (*Archiv f. Dermat. und Syphilis*, Band lxxxiv, Heft 1-3) report a series of 10 cases of mycosis fungoides with a study of the histology of 1 of them, both before and after treatment with the Röntgen rays. They were able to establish the fact that the mycosis infiltrate gradually entered the skin from the lower layers of the corium, and could distinguish the small mononuclear mycosis cells as specific structures. The vessels were greatly altered by endarteritis, and the connective tissue had undergone a peculiar (hyaline?) degeneration. The sweat glands were walled about and partly destroyed. After a short radiation there was exfoliation of the epidermis and infiltration of the whole tissue with polynuclear leukocytes, leading to a partial disappearance of the mycosis cells and of the peculiar changes in the connective tissue. After a longer radiation there was beginning regeneration of the epidermis with a great number of new-formed bloodvessels, and the tumor cells were reduced to a scanty remnant. The sweat glands were normal, but the connective tissue exhibited a peculiar degeneration.

related to *Streptococcus pyogenes*, not only morphologically and culturally, but also in pathogenic property. Its virulence is increased by repeated passages through rabbits, so that after five or more passages 2 c.c. of a twenty-four-hour-old culture produces death. The lesions produced in rabbits are the same in kind and extent as those produced by *Streptococcus pyogenes* obtained from pathological conditions in human beings.

Infantile Mortality and Goats' Milk.—The superiority of the goat over the cow in the matter of cleanliness (difference in character of excreta, disinclination to lie down in filth); its immunity to tuberculosis, as shown by the fact that not a single case of the disease has been observed among the hundreds of thousands of goats slaughtered at La Villette, in Paris; the greater digestibility of the curd, which is flocculent rather than hard, leads WILLIAM WRIGHT (*Lancet*, November 3, 1906) to advocate the use of goats' milk in place of cows' milk in infant feeding. He asserts that it is superior in nutriment and more suitable in every way; that its proportionate cost of production is far less; that the proportionate yield is far greater; and that if the animal is properly fed and restrained, the milk will have no odor.

Frequency of Tuberculosis in Dairies Supplying Paris.—According to H. MARTEL (*Revue de la Soc. scientif. d'hyg. aliment.*, 1906, ii, 559) of 628 cows whose milk constitutes part of the supply of Paris, 215, or 42.51 per cent., reacted to tuberculin. To avoid contagion at the cow-stable, he recommends the tuberculin test to prevent the introduction of diseased animals into a herd and periodical testing to discover and eliminate infected animals therefrom.

Cleanliness versus Pasteurization of Milk.—Concerning the comparative value of pasteurization of milk produced under ordinary conditions and of sterilization of the milk utensils and general cleanliness of production the experience of the Board of Health of Rochester, New York, as related by its Health Officer, GEORGE W. GOLER (*Arch. of Ped.*, September, 1906) is of great interest. During the quinquennium 1895 to 1900, children brought to the milk station were fed on pasteurized milk, and during the next same period they were given raw milk produced under sanitary conditions. In spite of increase in population due to natural increase and annexation, there were fewer deaths of children under five years of age during the latter period.

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HYGIENE AND PUBLIC HEALTH.

UNDER THE CHARGE OF

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Significance of Streptococci and Leukocytes in Milk.—In the author's abstract of a paper presented at the annual meeting of the American Public Health Association in the city of Mexico, in December, 1906, NORMAN MCLEOD HARRIS states that cultural and biological tests have failed to differentiate pathogenic from non-pathogenic forms of milk streptococci, although it is thought that milk obtained from cows suffering from acute mammitis is responsible for epidemics of severe sore-throat, tonsillitis, and gastro-intestinal disturbances in man. Hence, it would seem that in the absence of any such outbreaks the cocci are ordinarily to be considered as of no significance. With reference to the so-called pus cells in milk, we are at a disadvantage in having little definite information about normal leukocytosis. Concerning this point the observations of H. L. Russell and Conrad Hoffman (author's abstract—Leukocyte Content of Milk Drawn from Apparently Healthy Animals) are of value. From an examination of the several existing standards it is evident that there is a wide range in the limits which are recognized as indicating the presence of pus in milk and that data are altogether lacking to warrant the formulation of a proper scientific standard. They have examined milk from cows with no discoverable udder lesions or previous history of garget, and have found very wide variations, some specimens which are wholly satisfactory from a clinical standpoint yielding counts much in excess of accepted standards. They present data showing that "physiological leukocytosis may manifest itself in the milk of animals subjected to environmental conditions such as can in no material way affect the wholesomeness of the milk supply," and they emphasize the necessity of a thorough study of the subject before excluding from the market milk from cows in which no morbid processes can be detected.

W. RULLMANN and R. TROMSDORFF (*Arch. f. Hyg.*, 1906, lix, 224) confirm Bergey's statement that a large number of leukocytes in milk means a large content of streptococci, and they assert that the latter is always a consequence of mastitis, which disease appears to spread in some way unknown. They examined cows, which, as far as clinical evidence was concerned, were perfectly sound, and found that the milk of 19.5 per cent. thereof contained as much as 1 per cent. by volume of leukocytes. Doubtless, infection is spread by the milkers, and since mastitis makes milk dangerous and diminishes its yield, the strictest cleanliness on the part of the milker is necessary. The streptococci of the udder are especially dangerous to infants and young children.

According to P. G. HEINEMANN (author's abstract, The Pathogenicity of *Streptococcus lacticus*), *Streptococcus lacticus* is closely

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